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Stock Option Compensation and Equity Valuation

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Stock Option Compensation and Equity Valuation

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Dedication

To Baba, Mama, Yima

Mei, Yang,

and Ying

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Stock Option Compensation and Equity Valuation

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This dissertation provides a theoretical analysis and empirical investigation of the valuation implications of employee stock options. First, I modify the residual income model for stock valuation in the presence of employee stock options. I identify two distinct roles of employee stock options in valuation: current outstanding employee options and stock options expected to be issued to compensate employees in future periods. The value obtained from traditional residual income models must be adjusted for the value of outstanding options. In addition, the value of expected future employee stock options must be explicitly incorporated into the traditional residual income models when firms do not expense the fair value of options in net income.

Based on the analytical results, empirical tests are conducted to provide evidence on whether the effects of employee stock options are reflected in share prices. The results support the existence of a cross-sectional negative association

between share prices and both outstanding employee options and expected stock option expense. The findings are consistent with the modified residual income model in which outstanding employee options and expected stock option expense have distinct valuation effects. In addition to the association tests for the relation between share prices and information about employee options, I conduct event studies which provide evidence that SFAS No. 123 footnote disclosures communicate useful information about employee stock options to investors. Specifically, I find a negative association between unexpected stock returns and changes in stock option expense disclosed under SFAS No. 123 around firms' 10-K filings with the SEC. Taken together, the results from both the association study and the event study suggest that investors adjust share prices for the potential dilution caused by outstanding employee stock options, and recognize to some extent the compensation expense associated with stock option compensation.

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Chapter 1: Introduction

The use of stock option compensation in U.S. corporations has increased significantly over the last ten years. The average number of shares reserved for stock options as a percentage of shares outstanding for S&P 500 companies was 13.1% in 2000, compared to 9.2% in 1995 and 5.4% in 1989.[1] Stock option grants represent the single largest component of executive pay in recent years (Murphy 1999). They have also become an important part of non-executive employees' pay packages, especially in certain industries such as high-technology. As the size and value of employee stock options have increased, so have questions about their role in equity valuation. Standard valuation models in general do not explicitly specify the role of employee stock options. The current accounting treatment of employee stock options further complicates the valuation issue. Most companies report two sets of earnings: earnings before a charge of stock option expense in the income statements, and earnings after stock option expense in the footnotes to financial statements.[2] The existence of two earnings measures can lead to two estimates of value, raising questions about which measure is appropriate to use for valuation purposes. Moreover, regardless of the

[1] See the Investor Responsibility Research Center Potential Dilution study, 2001. The number of shares reserved for stock options is the number of options granted plus the number of shares authorized for future option grants.

[2] A detailed discussion of current accounting treatment of employee stock options is provided in section 2.1.1.

accounting method used for stock option expense, a firm's outstanding stock options can have a significant impact on shareholder value.

This paper addresses three questions related to the implications of employee stock options for equity valuation. The first question is how to incorporate employee stock options in residual income valuation. I modify the residual income model to explicitly account for the effects of employee options. Specifically, I identify two *distinct* roles of employee stock options in valuation: current outstanding employee options and stock options expected to be issued to compensate employees in future periods. The value obtained from a residual income valuation must be adjusted for the value of outstanding employee options, because outstanding options dilute existing shareholders' claims on future distributions. In addition, the value of common stock is affected by the value of options expected to be granted to employees in future periods. Future option issuance represents a cost that firms expect to incur to generate future revenues. The adjustment of the residual income model for future employee options is determined by the way options are expected to be accounted for. When the fair value of future options is expensed in expected future net income, the effect of future options is captured by the model through reduction of future residual earnings, therefore no adjustment is required. However, if firms choose not to recognize stock option expense, then the model needs to be modified through a subtraction of the discounted value of expected future employee options. The

analysis suggests that ignoring outstanding employee options or using a residual income measure that does not include expected stock option expense can lead to errors in the value estimates obtained from the traditional residual income model.

My second research question empirically examines whether stock prices reflect the valuation implications of employee stock options. Based on the analytical results discussed above, I predict that stock price is negatively associated with both the value of outstanding employee options and expected stock option expense, after controlling for current book value and expected future residual income before expected stock option expense. To examine this issue, I use hand-collected data related to outstanding employee options and stock option expense for S&P 1500 companies from their 10-Ks. The empirical tests are conducted using a regression specification that is based on the modified residual income valuation formula, and the model is estimated using a two-stage least squares technique. Consistent with predictions, I find that share prices are negatively related to both outstanding employee options value and expected stock option expense. The results suggest that the valuation implications of employee stock options are to some extent reflected in stock prices.

My third research question examines the market's response to disclosures in stock option footnotes. While firms are not required to recognize the fair value of option grants as an expense, they must disclose pro forma net income in the financial statement footnotes as if an expense had been recorded. In order to

provide evidence on whether investors use the disclosed stock option expense information when assessing firm value, I test for an association between unexpected stock option expense and unexpected stock returns cumulated over a three-day interval surrounding the dates when firms file their 10-Ks with the Securities and Exchange Commission (SEC) through EDGAR. I find that unexpected stock option expense is significantly negatively related to unexpected stock returns over the three-day window around 10-K filings. In contrast, I find no significant association between unexpected stock option expense and unexpected stock returns over a three-day interval around earnings announcement dates, or for the period between earnings announcements and 10-K filings. The evidence suggests that the release of financial statements provides useful information concerning a firm's stock option expense. It also suggests that stock option expense calculated based on the SFAS No. 123 methodology is viewed as sufficiently reliable to be used in firm valuation by investors.

Overall, this study adds to our understanding of the role of employee stock options in residual income valuation. Despite the extensive use of stock option compensation by U.S. corporations, there is surprisingly little research in the valuation literature that examines how to build employee stock options into a valuation model.[3] This study provides some guidance on how to apply the residual income model to value a firm with employee options. The analysis

would be of interest to investors, analysts, managers and other market participants who are interested in valuation. In addition, this study adds to the existing empirical literature on the relation between stock price and employee stock options. The theoretical analysis of the modified residual income model in this study enables more rigorous developments of hypotheses and empirical model specifications. Prior research has empirically examined either the relation between stock price and outstanding employee options (Aboody 1996); or the relation between stock price and stock option expense disclosed under SFAS No. 123 (Rees and Stott 1998, Bell et al. 2000, Aboody, Barth and Kasznik 2001). Based on the modified residual income model, I simultaneously examine both outstanding employee option value and expected stock option expense, and find results that are consistent with outstanding options and expected stock option expense having *distinct* valuation effects. In addition, because the value of outstanding employee options is likely to be correlated with expected stock options expense, the model that includes both variables is less subject to the correlated omitted variables problem.[4]

This study also contributes to the literature by conducting an event study to investigate the information content of stock option expense disclosed under

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[3] An exception is Soffer (2000), which examines employee stock options in the discounted cash flow valuation model.

[4] Minimizing biases in estimation due to the omitted variables problem is especially important in hypothesis testing that involves not only the direction but also the magnitude of the parameters tested, as in the case of the relation between stock prices and the value of outstanding employee

SFAS No. 123. Previous studies have investigated the value relevance of stock option expense using association studies. This study is the first to investigate whether the release of financial statements provides useful information about stock option expense to investors. The empirical results from the event study complement the association studies by providing more direct evidence on the causal link between disclosures of stock option expense information and changes in stock price.

Finally, the findings in this study provide some insights into the issue of recognition versus disclosure. There is little empirical evidence on the differences between the effects of recognition and disclosure due to the difficulties in designing such tests.[5] The evidence presented in this study reveals one aspect on which they differ: information in disclosed items is reflected into stock price later than that in recognized items. Specifically, I find that change in stock option expense disclosed under SFAS No. 123 is significantly related to stock returns around 10-K filing dates, but is not significantly related to stock returns around earnings announcement dates. The findings suggest that disclosing SFAS No. 123 stock option expense after earnings are announced delays the incorporation of information into stock prices. This evidence would be of interest to accounting regulators who make decisions regarding recognition and disclosure.

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options (hypothesized to be negative one). More discussions on this issue are provided in chapter 4.

[5] See Bernard and Schipper (1994) for a discussion of this issue.

I organize the dissertation as follows. The next chapter discusses the current accounting methods for employee stock options and the history of SFAS No. 123. A discussion of related prior research is also presented in chapter 2. Chapter 3 provides a theoretical analysis of the valuation implications of employee stock options and presents the residual income model modified to value a firm with employee options. Chapter 4 presents the empirical investigation of the valuation implications of employee stock options. The issues discussed include research design, sample selection, regression results and a series of sensitivity analysis. Chapter 5 presents the empirical tests on the information content of the disclosures of stock option footnotes at firms' 10-K filings with the SEC. Chapter 6 summarizes and concludes the study.

Chapter 2: Background and Prior Research

2.1 Background

2.1.1 Accounting for Employee Stock Options

Accounting for employee stock options (ESO) is one of the most controversial issues in financial reporting. The current accounting standard for stock option compensation is Statement of Financial Accounting Standards (SFAS) No. 123.[6] Under this standard, companies have the choice of recognizing stock option expense based on either the intrinsic value or the fair value of employee options on the measurement date.[7] The intrinsic value is the difference between the stock price and the exercise price of an option. The fair value of an option is determined by option pricing models that take into account current stock price, exercise price, expected dividend yield, expected risk-free interest rate, expected stock price volatility, and expected life of the option. Annual option compensation expense is determined by amortizing the grant date fair value of options over their vesting periods.

SFAS No. 123 encourages companies to use the fair value method which recognizes the fair value of stock options as an expense against earnings.

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[6] SFAS No. 123 became effective for fiscal years beginning after December 15, 1995. Accounting Principles Board Opinion (APB) No. 25 was the standard for employee stock options before SFAS No. 123, under which the intrinsic value method was required.

However, most firms adopt the intrinsic value method and issue stock options with exercise price equal to stock price on grant dates, and thereby recognize zero compensation expense.[8] If firms choose not to recognize the fair value of stock options in the income statements, they must disclose pro forma net income in the financial statement footnotes as if the fair value method had been applied. SFAS No. 123 also requires companies to disclose in the footnotes information related to their option plans and option transactions. The information includes, among other things, the number and weighted-average exercise price of options outstanding and exercisable at the end of the year, the number and weighted-average exercise price of options granted, exercised or expired during the year, and the weighted-average value of the inputs to the option pricing model employed in the calculation of option fair value.

2.1.2 History of SFAS No. 123

There was enormous controversy surrounding the issuance of SFAS No. 123.[9] The Financial Accounting Standards Board's (FASB) original position was to require companies to recognize fair value of stock options as an expense, as specified in the FASB's 1993 Exposure Draft. The FASB believed that employee

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[7] The measurement date is the date at which the number of options and the exercise price are known. The measurement date is the option grant date for fixed option plan, the most common option plan.

[8] Murphy (1999) reports that in a sample of 1000 large companies in 1992, 95% of CEO options are granted with exercise price equal to the grant date stock price. A study conducted by Bear, Stearns & Co. reports that only two of the S&P 500 companies use the fair value method under SFAS No. 123 in 2000: Boeing and Winn-Dixie.

stock options have value and represent a cost to shareholders, and that the value of options could be estimated with sufficient reliability. They therefore concluded that stock options should receive the same accounting treatment as other forms of employee compensation such as salary or stock grants.

However, the FASB's proposal was met with strong opposition and intense lobbying against the proposed recognition. Opponents argued that expensing stock-based compensation would adversely affect corporate earnings and hence stock prices, which would lead to higher costs of capital and ultimately would hurt the U.S. economy, especially the high-tech industries. The other major concern expressed by the opponents was the lack of reliability of the measure of option value due to the differences between employee options and standard call options. The intense pressure from the business community, especially corporate executives, and the government forced the FASB to compromise by allowing companies to disclose stock-based compensation expense in financial statement footnotes, instead of recognizing the expense in the income statement. In the final version of the standard, the FASB acknowledged the nature of its compromise and restated its belief that the fair value method was a superior way of accounting for employee stock options in SFAS No. 123 (SFAS No. 123, Appendix A).

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[9] See Dechow, Hutton and Sloan (1996) for a detailed discussion.

The accounting treatment of stock-based compensation has received increasing criticism in recent years. An article in the New York Times calls the accounting of stock option compensation "one of the prettiest lies in corporate America" (Morgenson, 2000). The recent stock market decline and the accounting scandals at Enron have drawn new attention on option accounting from investors and regulators. Federal Reserve Chairman Alan Greenspan has recently expressed concerns over option accounting. In a March 26 speech at New York University Stern School of Business, he argued that failure to report stock options as an expense "has created some perverse effects on the quality of corporate disclosures that, arguably, is further complicating the evaluation of earnings and hence diminishing the effectiveness of published income statements in supporting good corporate governance" (Greenspan, 2002). When asked at a recent congressional hearing what he would like to change in financial reporting, Greenspan was quoted as replying: "I would start off with the way we account for stock options" (Dizikes, 2002).

Currently, several lawmakers in Congress are pushing legislation that could change the way companies account for employee stock options.[10] At the same time, the International Accounting Standard Board (IASB) is considering a new standard for options that would require companies to recognize stock option

[10] On February 13, 2002 Senator Carl Levin and John McCain introduced a bill that would require corporations to expense employee stock options on their income statements if the firms claim tax deductions for the options. Fortney Stark introduced a similar house version of the bill. Both bills are pending.

compensation expense.[11] SEC Commissioner Isaac Hunt suggests that the FASB or the SEC wait for progress on the IASB's option project before re-addressing the issue (Hunt, 2002).

2.2 Prior Research

There is a longstanding literature in corporate governance that examines executive equity compensation and managerial incentives. However, the implications of employee stock options for the measure of accounting earnings and stock valuation had not been the subject of research until the heated debate on the FASB's Exposure Draft on option accounting in the 1990s. I provide a summary of these studies in the remaining of this chapter.

2.2.1 Stock Prices and Outstanding Employee Stock Options

Aboody (1996) examines whether investors incorporate the value of outstanding employee options into stock prices by estimating the contemporaneous relation between stock prices and the value of outstanding options. Aboody argues that employee stock options have two offsetting effects on stock prices: a dilution effect and a benefit effect. Specifically, employee stock options dilute existing shareholders' claims on future cash flows and hence have a negative effect on share prices. At the same time, employee options can

[11] The IASB has scheduled an Exposure draft on stock-based compensation for September 2002, and voting for November 2002. The information is available from the IASC Web site http://www.iasc.org.uk.

positively affect share prices because they can provide incentives to managers and employees to increase firm value. Therefore, the association between stock prices and outstanding employee options depends on the relative strength of the two effects: negative if the dilution effect outweighs the benefit effect, and positive if otherwise. He finds a significantly negative relation between share prices and outstanding employee options in a cross sectional regression that controls for current book value and earnings. Because option value is a function of the market price of the underlying stock which causes a mechanical positive relation between share price and option value, the model is estimated using the two-stage least squares technique.

2.2.2 Stock Prices and Stock Option Expense

Rees and Stott (1998), Bell et al. (2000) and Aboody, Barth and Kasznik (2001) empirically examine the relation between stock prices and stock option expense disclosed in the financial statement footnotes as required by SFAS No. 123. All three studies focus on stock option expense and do not investigate the role of outstanding stock options.[12] Rees and Stott (1998) find a significant positive relation between stock option expense and stock returns, which they

[12] Rees and Stott (1998) and Aboody, Barth and Kasznik (2001) motivate their studies as extensions of Aboody (1996). They argue that their studies examine stock option expense which is calculated and disclosed by companies, while Aboody (1996) has to estimate the value of outstanding employee options and hence is potentially subject to greater measurement errors. However, as discussed in chapter 3, stock option expense and outstanding stock options do not substitute for each other; instead, they represent two distinct factors in the residual income valuation model.

interpret as evidence that employee stock options have net positive effects on share prices. Similarly, Bell et al. (2000) find a significant positive relation between share prices and stock option expense after controlling for current book value and net income for a sample of firms in the computer software industry. They also provide evidence that employee stock options create a valuable intangible asset. The authors interpret the results as evidence consistent with the market on average viewing stock option expense not as an expense but as an asset.

Aboody, Barth and Kasznik (2001) differ from prior research in that they explicitly control for the benefit effects of employee options in the regression models. They argue that the relation between stock prices and stock option expense should be negative after the benefit effects of stock options are controlled for. Analysts' forecasts of long term earnings growth are used to proxy for the benefits provided by stock options. After controlling for the benefit effects in this way, they find a negative relation between share prices and stock option expense in a regression that also includes current book value and net income. Following Aboody (1996), they estimate the model using the two-stage least squares method.

2.2.3 Returns-Earnings Relation, EPS and Outstanding Employee Stock Options

Huson, Scott and Wier (2001) take a different approach to investigate whether investors recognize the potential dilution caused by outstanding dilutive securities.[13] Specifically, they examine how the level of outstanding dilutive securities affects the association between stock returns and accounting earnings. They predict that earnings response coefficients (ERCs) are negatively related to the level of outstanding dilutive securities. In other words, they predict that for a given amount of unexpected earnings, stock price changes associated with the news would be weaker when a firm has a higher level of potential dilution, because some of the value changes induced by the news accrue to the holders of the dilutive securities. Consistent with expectations, they find a negative relation between ERCs and the percentage of shares reserved for conversion of dilutive securities. This negative relation exists even when EPS measured on a dilutive basis is used in the regression analysis, suggesting that dilutive EPS calculated based on SFAS No. 128 understates potential dilution.

One limitation of Huson et. al (2001), as acknowledged by the authors, is that they use the *number* of shares reserved for conversion as the proxy for dilution, which is a very imprecise measure. The goal of their study is to provide empirical evidence on the statistical relation between ERCs and dilution of

[13] Their analysis includes not only employee stock options but also other types of dilutive securities such as warrants, convertible debts and convertible preferred stock.

earnings caused by outstanding dilutive securities, but not to derive a measure of dilution that can be incorporated in a valuation model.

Core, Guay and Kothari (2002) extend Huson et. al (2001) by deriving a measure of EPS that captures the effect of dilution caused by outstanding employee stock options. They argue that diluted EPS computed using the treasury stock method under SFAS No. 128 understates the diluted effect of stock options, because the treasury stock method measures dilution based on the intrinsic value of options, while their new method measures dilution based on the fair value of options. They report that, for their sample firms, dilution in EPS under the new method is 100% greater than that in reported diluted EPS under the treasury stock method. The study also finds that ERCs are smaller for firms that have a greater difference between the new measure of dilution and dilution as measured in reported diluted EPS.

It is important to point out that the focus of Core et. al (2002) is on the implications of option dilution for measuring earnings per share. The authors acknowledge that "the computation of per share earnings is not a necessary intermediate step in estimating stock price" (footnote 5, page 9).[14] In addition, both Huson et al. (2001) and Core et al. (2002) focus on the effects of outstanding employee stock options. Although Core et al. (2002) point out that employee

[14] The alternative method is to determine the total value of equity and then estimate the portion of equity accruing to common shareholders. This is the approach I take to extend the residual income model to incorporate employee stock options. See chapter 3 for a detailed discussion.

stock options have an impact on both the denominator and numerator of EPS, the study focuses on the denominator effect of outstanding options in the EPS calculation.

Taken together, the existing studies establish a link between share prices and either outstanding employee options or stock option expense, and a link between outstanding employee options and the measure of EPS. Collectively the evidence is consistent with stock option information being value relevant. However, none of these studies examine the distinct effects of outstanding employee stock options and expected stock option expense on estimating firm value using a valuation model such as the residual income model. In addition, the evidence on the association between share prices and stock option expense provided by existing studies is inconsistent. Specifically, Rees and Stott (1998) and Bell et al. (2000) find a positive relation between stock prices and stock option expense, while Aboody, Barth and Kasznik (2001) find a negative association. Finally, these studies do not provide evidence on the information content of the disclosures of stock option information under SFAS No. 123.

Chapter 3: Modeling the Valuation Implications of Employee Stock Options

The first research question addressed in this study is how to value a firm with stock option compensation using the residual income valuation framework. In this chapter, I present the traditional residual income model, and then discuss how to extend the model to incorporate employee stock options. The analysis shows that employee stock options have two *distinct* roles in stock valuation: current outstanding employee options and stock options expected to be issued to employees in the future. The value obtained from the traditional residual income model has to be adjusted for the value of current outstanding options regardless of the accounting method used for employee options. However, how future employee options are incorporated into the model depends on the way options are expected to be accounted for. Additional analysis is provided to illustrate that the analytical results are consistent with the conventional view of the residual income model regarding the effects of different accounting choices on valuation. Moreover, in order to provide some intuition for the modified residual income model, I analyze and compare the implications of anticipated future employee option issuance and future common stock issuance for residual income valuation. Appendix A explains why an adjustment similar to the anticipated employee option adjustment is not required for anticipated common stock issues.

3.1 The Traditional Residual Income Model

The residual income model expresses equity value as the sum of book value of equity and the present value of expected residual income, where residual income is defined as earnings less a charge for the cost of capital (see, e.g., Preinreich 1938, Edwards and Bell 1961, Peasnell 1982, Ohlson 1995, and Feltham and Ohlson 1995). The residual income model is based on the notion that the value of equity is the present value of expected future dividends. This dividend discount model is given by:

$$V_t^E = \sum_{i=1}^{\infty} \frac{E_t\left[DIV_{t+i}\right]}{(1+r)^i}, \tag{3.1}$$

where V_t^E is the value of equity at time t; DIV_{t+i} is dividends net of capital contribution paid at time $t + i$; r is cost of equity capital (assumed constant); and $E_t[.]$ denotes expectation conditional on information available at time t.

The main assumption required to equate the residual income model and the dividend discount model is an accounting system that satisfies a clean surplus relation specified as:

$$BV_t = BV_{t\text{-}1} + NI_t - DIV_t, \tag{3.2}$$

where BV_t represents book value of equity at time t and NI_t represents earnings to shareholders for the period ending at t. Using equation (3.2) and assuming a regularity condition that the discounted book value converges to zero as i goes to

infinity, the value of equity can be restated as a function of current book value and discounted expected residual income:[15]

$$V_t^E = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i}. \qquad (3.3)$$

In equation (3.3), both book value and earnings are defined in terms of current equity holders. For a firm that has no employee stock options or other derivative securities, common shareholders represent the only group who contribute equity capital (BV_t) and the only claimants on future residual earnings. Thus, under these circumstances, the value of equity given by equation (3.3) is the value of outstanding common stock.[16] In a more general form, the residual income model can be used to value any investment as the sum of the amount invested plus the discounted residual income expected to be generated by the investment. Thus, depending on how invested capital and residual earnings are defined, the model can be used to derive value to shareholders, or value to both shareholders and debtholders, or value to other stakeholders who contribute invested capital and thus have a claim on future earnings (see, e.g., Peasnell 1982). For example, if the objective is to value claims on a firm's total assets, then invested capital will be book value of a firm's assets, net income will be

[15] See Feltham and Ohlson (1995) for a detailed derivation.

[16] For simplicity I assume no other contingent equity claims, such as warrants (options issued to nonemployees) and convertible preferred stocks, for firms with or without employee options. However, the analysis on outstanding employee stock options can equally be applied to other contingent equity claims.

income before interest, and future residual income will be discounted at the firm's weighted-average cost of equity and debt.[17]

3.2 Incorporating Employee Stock Options into the Residual Income Model

Now consider a firm that has employee stock options outstanding and is expected to issue additional stock options to compensate employees for future operations. In addition, assuming that the firm accounts for employee options using the intrinsic value method. Without loss of generality, define NI_{t+i} as earnings before a charge for the fair value of options issued in period $t + i$; other variables are as defined above. The equity value (V_t^E) given by equation (3.3) is no longer equal to the value of outstanding common stock. Instead, it represents the value attributable to three groups of stakeholders: current common shareholders, employees who own current outstanding stock options, and employees who expect to receive options in future periods, and can be represented as follows:

$$V_t^E = V_t^S + V_t^O + V_t^{FO}, \tag{3.4}$$

where V_t^S is the value of outstanding common stock, V_t^O is the value of outstanding stock options, and V_t^{FO} is the expected present value of options to be issued in all future periods. The reasons are as follows. First, employees who

[17] In this case *DIV* will be cash payments to all claimholders, including dividends and interest payments. As long as the definition of *DIV* is consistent with *BV* and *NI* and the clean surplus

own outstanding stock options contribute capital by forsaking the cash salaries they would have received if they were not compensated by stock options in exchange for a claim on future residual earnings that is a component of V_t^E.[18]

Second, the value of employee options expected to be granted in the future is also reflected in V_t^E. The reason is directly related to the intrinsic value method used to account for stock options. Issuing options to employees in future periods results in a reallocation of claims on subsequent earnings between existing security holders (i.e., holders of outstanding common shares and options) and future option holders. Employees who receive options in period $t + i$ have claims on earnings earned after period $t + i$. This is analogous to an expected future issue of stock or options to outside investors except that issuing options to employees does not result in cash inflows to the firm at the grant date. Instead, the firm receives employees' services in return for giving up a portion of claims to future earnings, the value of which represents the cost that the firm expects to incur to generate an expected level of future revenues.

Let ESO_{t+i} denote the fair value of options granted in period $t + i$, thus ESO_{t+i} represents the expected value of the share of future earnings that accrues to period $t + i$ option holders. The claims on period $t + i$ earnings that accrue to

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relation holds, the proof of the equivalence of the residual income model and the dividend discount model in an equity valuation setting can equally be applied to other settings.

[18] An alternative interpretation for V_t^O is to treat outstanding employee options as debt from current common shareholders' perspective. Correspondently, V_t^O represents the sum of the book value of the debt (i.e., the fair value of options on the grant date) and the gains or losses from this

existing security holders is ($NI_{t+i} - ESO_{t+i}$), with ESO_{t+i} representing a cost to current security holders. However, because accounting inputs to equation (3.3) are based on the intrinsic value method, V_t^E is computed using earnings before stock option expense (NI_{t+i}) rather than ($NI_{t+i} - ESO_{t+i}$). As a result, V_t^E includes claims on future earnings that accrue to future option holders, and the present value of the claims, V_t^{FO}, can be expressed as the sum of the discounted expected value of all future options ($\sum_{i=1}^{\infty} \frac{E_t[ESO_{t+i}]}{(1+r)^i}$). Thus equation (3.4) can be rewritten as:

$$V_t^E = V_t^S + V_t^O + \sum_{i=1}^{\infty} \frac{E_t[ESO_{t+i}]}{(1+r)^i}. \tag{3.4'}$$

Combining equations (3.3) and (3.4') and rearranging yields an expression for the value of outstanding common shares V_t^S:[19]

$$V_t^S = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i} - V_t^O - \sum_{i=1}^{\infty} \frac{E_t[ESO_{t+i}]}{(1+r)^i}, \tag{3.5}$$

or

$$V_t^S = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[(NI_{t+i} - ESO_{t+i}) - r * BV_{t+i-1}\right]}{(1+r)^i} - V_t^O. \tag{3.6}$$

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financing activity (i.e., the difference between the fair value of options at valuation date *t* and at grant date).

[19] The anticipated cash inflows associated with the exercise of employee options in future periods are included in expected future book value. Like other financing activities, the residual income to common stockholders would not be affected by the added capital unless it is expected to yield returns different from the required cost of capital.

Equations (3.5) and (3.6) present two equivalent ways of thinking about valuing common shares for firms with employee stock options. In equation (3.5), earnings before ESO_{t+i} is used to compute the value of total equity, and the fraction of the value accruing to future option holders is subtracted to obtain the value of current common shares and options. Equation (3.6) directly computes the value of current outstanding securities (i.e., outstanding common shares and employee options) by using earnings after ESO_{t+i}. In both cases, the value of current options outstanding, V_t^O, is deducted to determine the value of current common stock.[20]

3.3 The Benefit Effects of Employee Stock Options

The above analysis focuses on capturing the costs of employee options to current shareholders. It is important to point out that stock option compensation may have benefit effects. The benefit effects, however, do not appear in equations (3.5) and (3.6) as a separate variable. In fact, the benefit effects are incorporated into the model in the forecasts of future earnings. There are two main reasons why employee stock options could lead to higher expected future earnings. First, by replacing cash compensation with stock options, the firm is able to reserve funds which, if invested in projects that earn a return greater than

[20] The process of estimating the value of both common stock and outstanding employee options and then deducting outstanding options to obtain the value of common stock is analogous to the process of estimating the value of total assets and then deducting debts to obtain the value of equity.

cost of capital, will increase future earnings. Second, consistent with agency theory, stock-based compensation may provide incentives to managers and employees which translate into higher future earnings. Stock option compensation can create value for shareholders when the benefits it provides outweigh its costs

3.4 Different Accounting Methods and the Residual Income Model

Equation (3.6) suggests that when earnings are properly measured, the residual income model does not require an explicit adjustment for future option issuance. At first glance, the results seem to be inconsistent with the conventional view that the value obtained from the residual income model is unaffected by different accounting methods as long as the accounting system obeys the clean surplus relation. However, there is another implicit assumption underlying the clean surplus relation, which is that the sum of net incomes recognized over the life of the firm is unaffected by different accounting methods. The choice between the intrinsic value method and the fair value method affects the aggregate amount of earnings recognized, and therefore violates this assumption. This point is discussed further below.

The residual income model is derived from the dividend discount model. The intuition behind the residual income model is to use book value and forecasted future earnings to back out dividends using the clean surplus relation:

$BV_t = BV_{t-1} + NI_t - DIV_t$, so that (3.7)

$$DIV_t = BV_{t-1} + NI_t - BV_t.$$

For a given time series of dividends, ($DIV_1, DIV_2, \ldots, DIV_i, \ldots$), there are indefinite number of combinations of earnings and book value that satisfy the clean surplus relation. However, there is an implicit relation between the sum of net income and the sum of dividends over the life of the firm. Dividends for each period can be written as:

$$DIV_1 = BV_0 + NI_1 - BV_1,$$

$$DIV_2 = BV_1 + NI_2 - BV_2,$$

$$DIV_3 = BV_2 + NI_3 - BV_3,$$

.

.

Adding up these equations and assuming book value converges to zero as i goes to infinity, we obtain the following equation:

$$\sum_{i=1}^{\infty} DIV_i = BV_0 + \sum_{i=1}^{\infty} NI_i \,. \tag{3.8}$$

That is, over the life of the firm, the aggregate amount of dividends is beginning book value plus the aggregate amount of net income. The clean surplus relation (3.7) and equation (3.8) can be viewed as two requirements for different accounting choices to have no effect on valuation. For a given time series of dividends, the aggregate amount of net income that can be recognized is fixed. As long as the sum of recognized net income remains unchanged and the clean

surplus relation is observed in each period, a firm can choose to recognize net income in different periods and in different patterns for the same underlying economic activities, and such accounting varieties have no effect on the residual income valuation. In general, accrual accounting is consistent with such a requirement. For example, a firm may decide to recognize lower depreciation expense and higher earnings in a certain periods, but this yields lower subsequent earnings because higher depreciation expense will have to be recognized in future periods for a given amount of fixed assets. Over the life of the firm, the aggregate amount of earnings is unaffected by the timing of depreciation expense recognition.

The intrinsic value method for employee options, however, recognizes more aggregate earnings than the total earnings recognized under the fair value method. Suppose a firm is expected to issue stock options to employees in period $t + i$, and the fair value of the options is ESO_{t+i}. Accounting earnings for period $t + i$ under the intrinsic value method would be higher than earnings under the fair value method. More importantly, unlike the depreciation expense example, the higher earnings recognized in period $t + i$ under the intrinsic value accounting do not result in lower earnings for subsequent periods. In other words, earnings in subsequent periods are not affected by the accounting method for employee

options used in period $t + i$.[21] As a result, for the same firm, the aggregate earnings recognized under the intrinsic value method are higher than the earnings recognized under the fair value method by $\sum_{i=1}^{\infty} ESO_{t+i}$. As shown by equation (3.8), a higher $\sum_{i=1}^{\infty} NI_i$ corresponds to a higher $\sum_{i=1}^{\infty} DIV_i$, which could result in a higher valuation. In fact, as shown in the following analysis, the intrinsic value method overstates both net income and net dividends in period $t + i$ by not recording the capital contributed by employees who receive the options.

Let NI_{t+i} be earnings before ESO_{t+i} for period $t + i$. If the firm follows the intrinsic value method and does not record the transaction of issuing employee stock options, the clean surplus relation is:

$$BV_{t+i} = BV_{t+i\text{-}1} + NI_{t+i} - DIV_{t+i}. \tag{3.9}$$

On the other hand, if the firm follows the fair value method, which requires a journal entry of a debit to retained earnings and a credit to paid-in capital - stock option, the clean surplus relation becomes:

$$BV_{t+i} = BV_{t+i\text{-}1} + (NI_{t+i} - ESO_{t+i}) - (DIV_{t+i} - ESO_{t+i}). \tag{3.10}$$

Equation (3.9) is equivalent to (3.10), but earnings and dividends are defined differently. NI_{t+i} and DIV_{t+i} represent earnings and dividends under the intrinsic

[21] In fact, if more options are expected to be issued in subsequent periods, then earnings under the intrinsic value method for those periods would always be higher than earnings under the fair value method. In the extreme situation, suppose a firm pays all expenses using options and accounts for

value method. When the fair value method is used, earnings for period $t + i$ becomes ($NI_{t+i} - ESO_{t+i}$), and *dividends net of capital contribution* is ($DIV_{t+i} - ESO_{t+i}$).[22]

As a result, under the intrinsic value method, the time series of earnings and dividends are (NI_{t+1}, NI_{t+2}, . . ., NI_{t+i}, . . .) and (DIV_{t+1}, DIV_{t+2}, . . ., DIV_{t+i}, . . .), respectively. While under the fair value method, the time series of earnings and dividends are ($NI_{t+1} - ESO_{t+1}$, $NI_{t+2} - ESO_{t+2}$, . . ., $NI_{t+i} - ESO_{t+i}$, . . .) and ($DIV_{t+1} - ESO_{t+1}$, $DIV_{t+2} - ESO_{t+2}$, . . ., $DIV_{t+i} - ESO_{t+i}$, . . .), respectively. Different series of dividends yield different values of equity. Specifically, under the intrinsic value method, the value of equity is:

$$V_t^E = \sum_{i=1}^{\infty} \frac{E_t\left[DIV_{t+i}\right]}{(1+r)^i}, \text{ or equivalently:} \tag{3.11}$$

$$V_t^E = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i}.$$

Under the fair value method, the value of equity is:

$$V_t^{'E} = \sum_{i=1}^{\infty} \frac{E_t\left[DIV_{t+i} - ESO_{t+i}\right]}{(1+r)^i}, \text{ or equivalently:} \tag{3.12}$$

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the options using the intrinsic value method, then the firm recognizes no expense and the aggregate amount of net income would be equal to the aggregate amount of revenues.

[22] It is important to emphasize the differences between accounting methods for employee options and accounting methods for other transactions such as depreciation expense. Generally, different accounting methods affect the measure of earnings and ending book value by the same amount, and have no effect on dividends. For example, a firm may recognize a smaller amount of depreciation expense in a certain periods, which increases same period earnings and ending book value but has no effect on dividends. In the case of option accounting, however, ending book

$$V_t^{'E} = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[(NI_{t+i} - ESO_{t+i}) - r * BV_{t+i-1}\right]}{(1+r)^i}.$$

Do equations (3.11) and (3.12) imply that using different accounting methods for employee options leads to different values for common shareholders? The answer is obviously no. In equation (3.12), dividends net of capital contributed by future option holders are used, which offsets the part of dividends accruing to future option holders.[23] Equation (3.11) uses dividends before the deduction of capital contribution, therefore represents the value of claims to both current security holders (common stock and currently outstanding options) and future option holders. Consequently, in order to obtain the value for current security holders, the value of future employee options must be deducted. If the goal is to estimate the value of common shares, then the value of current outstanding employee options must also be deducted, and we obtain:

$$V_t^S = \sum_{i=1}^{\infty} \frac{E_t\left[DIV_{t+i}\right]}{(1+r)^i} - \sum_{i=1}^{\infty} \frac{E_t\left[ESO_{t+i}\right]}{(1+r)^i} - V_t^O, \tag{3.13}$$

which is equivalent to equation (3.5):

$$V_t^S = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i} - \sum_{i=1}^{\infty} \frac{E_t[ESO_{t+i}]}{(1+r)^i} - V_t^O.$$

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value remains the same under both methods, but the amount of dividends is affected by the choice of the intrinsic value or the fair value method.

[23] Granting stock options to employees is equivalent to a combination of two transactions: a financing transaction (issuing options to raise cash) and an operating transaction (using the proceeds to pay employees). The option holders, who happen to be the employees, contribute capital to the firm in the amount of the fair value of options. Under the fair value method, when option compensation expense is recorded, contributed capital increases by the same amount.

3.5 Anticipated Employee Stock Option Issues versus Common Share Issues

This section provides some analysis on the reason why the traditional residual income model is adjusted for anticipated future employee option issues but not for anticipated future common share issues. More analysis is provided in Appendix A. As discussed earlier, the reason for the subtraction of future option issuance is because of improper accounting, not because of the nature of the underlying transactions. In fact, when the fair value method is used, such adjustment is not necessary, because the fair value method does not result in overstated net income and net dividends. The dividend discount model is capable of valuing a firm with expected equity transactions, which is the reason why the dividend discount model requires the input to be *net* dividends, or dividends net of capital contributions. As long as equity transactions are properly accounted for in the accounting system, the residual income model is also capable of valuing a firm with such transactions. For example, when common shares are issued, a firm would debit cash and credit paid-in capital. Therefore, net dividends equal cash dividends minus the proceeds from share issuance, and net income for the same period is not affected. On the other hand, if the firm mistakenly debits cash and credits net income, net income and net dividends would both be overstated, which would lead to incorrect valuation in the residual income model and dividend discount model. So, the need to adjust the traditional residual income model for future option issues under the intrinsic value method is the result of inadequate

accounting for employee options. It does not imply the necessity of such adjustment for other anticipated equity transactions that are properly accounted for.

Chapter 4: Empirical Investigation of the Valuation Implications of Employee Stock Options

The analysis described in chapter 3 provides a theoretical basis for empirical investigation of whether stock prices reflect the valuation implications of stock option compensation. The modified residual income model predicts a negative association between share prices and both the value of outstanding employee options and expected future stock option expense after controlling for current book value and expected future residual earnings before stock option expense. This chapter presents the research design and findings for the empirical investigation of this issue.

4.1 Research Design

4.1.1 Regression Model

The primary regression model, which is based on equation (3.5) in chapter 3, is specified as:

$$P_{jt} = a_0 + a_1 BV_{jt} + a_2 RI_{jt+1} + a_3 RI_{jt+2} + a_4 RILTG_{jt} + a_5 FESO_{jt} + a_6 OESO_{jt} + \varepsilon_{jt}, \quad (4.1)$$

where:

P_{jt}: share price at the end of the third month after fiscal year end t for firm j;

BV_{jt}: book value per share at fiscal year end t for firm j;

RI_{jt+1}: Expected residual earnings for year $t + 1$, calculated as $ENI_{jt+1} - r * BV_{jt}$, where ENI_{jt+1} is analysts' earnings per

share (EPS) forecast for fiscal year $t + 1$, from /I/B/E/S, made in the fourth month after fiscal year end t, and r is cost of equity capital;

RI_{jt+2}: Expected residual earnings for year $t + 2$, calculated as $ENI_{it+2} - 0.12 * (BV_{jt} + ENI_{it+1} - EDIV_{it+1})$, where ENI_{jt+2} (ENI_{it+1}) is analysts' EPS forecast for fiscal year $t + 2$ ($t + 1$), from /I/B/E/S, made in the fourth month after fiscal year end t, and $EDIV_{it+1}$ is expected dividends per share in period $t + 1$.

$RILTG_{jt}$: $RI_{jt+2} * GROWTH$, where $GROWTH$ is analysts' forecast of long term earnings growth, from I/B/E/S, made in the fourth month after the end of fiscal year t;

$FESO_{jt}$: proxy for expected future stock option expense divided by number of common shares outstanding at fiscal year end;

$OESO_{jt}$: fair value of total outstanding employee options, adjusted for tax benefits of employee stock options, divided by number of common shares outstanding at fiscal year end.

Consistent with the residual income model and prior research, I expect coefficients a_1, a_2, a_3 and a_4 to be positive. Based on equations (3.5) and (3.6), I predict a_5 and a_6 to be negative. In addition, because the theoretical value of a_6 is -1, I test the hypothesis of $a_6 = -1$. The specifics of the model estimation procedure are discussed in detail below.

4.1.2 Computation of Variables

Expected future residual income (RI) and forecast horizons. I use I/B/E/S consensus earnings forecasts to proxy for market expectations of future earnings. Although equity value is theoretically a function of an infinite series of future residual earnings as shown in equations (3.5) and (3.6), analyst forecasts of future

earnings in I/B/E/S are typically available only for one-year-ahead, two-year-ahead earnings and long term earnings growth. As a result, the regression model is restricted to three earnings term.[24] Expected residual earnings for year $t + 1$ ($t + 2$), or RI_{jt+1} (RI_{jt+2}), is computed as analysts' forecast of EPS for year $t + 1$ ($t + 2$) minus year t ($t + 1$) book value per share times cost of capital. A constant cost of capital of 12% is used for all firms.[25] In the calculation of RI_{jt+2}, book value for year $t + 1$, or BV_{t+1}, is estimated using the clean surplus relation. Specifically, BV_{t+1} is calculated as BV_t plus expected EPS for $t + 1$ minus expected dividends per share for $t + 1$. Assuming firms continue their current dividends payout ratios into future years, expected dividends for $t + 1$ is computed as year t dividends payout ratio times forecasted year $t + 1$ EPS.

In addition to RI_{jt+1} and RI_{jt+2}, I include the variable *RILTG* in the regression to proxy for expected long term earnings. *RILTG* is computed as RI_{jt+2} times analysts' forecast of long term earnings growth. The purpose of including *RILTG* is twofold. First, *RILTG* acts as a proxy for information about future residual earnings that is not captured by the one-year-ahead and two-year-ahead residual earnings. Furthermore, as discussed earlier, the positive effects of stock option compensation are reflected in the valuation model through expected future

[24] More discussion on proxies for expected future residual earnings is provided in section 4.5.2.
[25] It is not uncommon for empirical studies of the residual income model to assume a constant cost of capital, in part due to the difficulty of estimating firm-specific costs of capital. For example, Bernard (1995) and Tse and Yaansah (1998) use a cost of capital of 13%, and Dechow, Hutton and Sloan (1999) uses 12%. I obtain similar results using a cost of capital ranging from 8% to 14%.

earnings. To the extent that the benefits provided by employee options are not reflected in the one-year-ahead and two-year-ahead residual earnings, *RILTG* captures the positive effects of option compensation on future earnings.[26] Because of the potential positive relation between earnings growth and both *FESO* and *OESO*, failing to control for expected earnings growth in the regression could bias the estimates of coefficients on *FESO* and *OESO* (Skinner 1996, Aboody, Barth and Kasznik 2001).

Expected future stock option expense (FESO). Because most firms do not recognize the cost of stock options in reported earnings, analysts are not likely to include stock option expense in their forecasts of future earnings. Thus, in equation (4.1), the variable *RI* represents expected residual income before stock option expense, and future stock option expense is included in the model as a separate explanatory variable. Because no analyst forecast of stock option expense is available, I use current stock option expense as a proxy for future stock option expense.[27]

Fair value of outstanding options (OESO). I adopt the dividend-adjusted version of the Black-Scholes model, as modified in SFAS No. 123, to estimate the fair value of a firm's outstanding options (Black and Scholes 1973, Merton 1973, and SFAS No. 123). The Black-Scholes option pricing formula is given by:

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[26] As discussed in section 2.2.2, Aboody, Barth and Kasznik (2001) include analysts' forecast of long term earnings growth in the regression to control for the benefits provided by stock options.
[27] Alternative proxies for expected stock option expense are discussed in section 4.5.3.

$$Option\ value = P\, e^{-ln(1+d)T}\, N(z) - X\, e^{-ln(1+r)T}\, N(z - \sigma\, T^{1/2}), \quad (4.2)$$

where:

P: stock price at valuation date;
X: exercise price of the option;
d: expected annual dividend yield;
r: risk-free interest rate;
σ: expected annual stock price volatility;
T: expected life of the option (years);
N(.): cumulative normal distribution function;
z: $[ln(P/X) + T\,(ln(1+r) - ln(1+d) + \sigma^2/2)] / \sigma T^{1/2}$.

At a specific point in time, a firm's outstanding employee options are likely to be an option portfolio that consists of options granted in different periods with various exercise prices and expected remaining lives. One can estimate the value of each option grant and sum them up to obtain the value of total outstanding options. However, estimating the value for each option grant requires extensive data collection from many years of financial statements and assumptions regarding the composition of the option portfolio. I use the "one-year approximation method" developed by Core and Guay (2000). A firm's outstanding employee options are valued as if they were a single option grant, and weighted average exercise price and weighted average expected remaining life are used as inputs to the Black-Scholes model.[28] The fair value per option is then

[28] Core and Guay (2000) show that the values of option portfolios produced by the one year approximation method are highly correlated with the values estimated using full information, with the one year approximation values capturing more than 98% of the variation in the full information values.

multiplied by the number of employee options outstanding to obtain the value of total outstanding employee options.

Among the six input variables to the Black-Scholes model, *P* is share price at the end of the third month after fiscal year end and is obtained from CRSP. *X* represents the weighted average exercise price of outstanding employee options, which is required to be disclosed under SFAS No. 123. I use average dividend yield over the past three years as a proxy for expected dividend yield, where dividend yield is the ratio of dividends per share to share price at fiscal year end. The risk-free interest rate is measured as the yield on U.S. Treasury securities with a term equal to the weighted average expected remaining life of options outstanding. Expected stock price volatility is estimated as the annualized standard deviation of monthly stock return measured over the past 60 months.[29]

For the last input variable, *T*, I adopt the FASB's adjustment to the standard option pricing models and use options' expected life rather than their contracted term to maturity. Employee stock options differ from publicly traded options in ways that violate the assumptions underlying standard option pricing models.[30] One important feature of employee stock options is that they are not transferable. As a result, employee options are likely to be exercised early for diversification or liquidity purposes (see, e.g., Huddart 1994, Huddart and Lang

[29] For companies that have less than 60 months of return data, I require a minimum of 20 months to compute stock price volatility.

1996). In addition, employees have to either exercise or forfeit their options when they leave the company. Early exercise and possible forfeiture reduce the value of options and thus the costs of options to shareholders. In order to incorporate the effects of early exercise, the FASB requires the use of an option's expected life instead of its contracted life to determine stock compensation expense. Although the FASB's modification to the option pricing model may not fully capture the effects of the differences between employee stock options and standard options, there is evidence that the method provides a reasonable estimate of employee option value (Carpenter 1998).[31] To the extent that the method provides an inaccurate value of employee options, there are measurement errors in the estimated value of outstanding options.

Expected remaining life of options outstanding is not required to be disclosed under SFAS No. 123 and thus must be estimated. I measure expected remaining life of outstanding employee options as their expected life estimated at grant date minus the age of these options. The age of outstanding options is measured as the difference between their maximum contractual life and their remaining contractual life.

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[30] A number of studies examine the issue of how to value employee stock options, e.g., Jennergren and Naslund (1993), Hemmer, Matsunaga and Shevlin (1994), Huddart (1994), Kulatilaka and Marcus (1994), Rubinstein (1995) and Carpenter (1998).

[31] For example, to fully account for the effects of early exercise, the option pricing model would have to include variables such as employees' risk aversion and outside wealth (e.g., Huddart 1994, Kulatilaka and Marcus 1994). Carpenter (1998) shows that the values of employee stock options produced by the FASB's methodology are very close to those of a more complex model that

The last step in calculating *OESO* is to adjust the estimated value of outstanding stock options for the expected tax benefits of employee options. For tax purposes employee stock options are classified into two types: incentive stock options and nonqualified stock options. Nonqualified stock options give rise to a tax deduction to the firm when these options are exercised. The amount of the tax deduction equals the excess of the stock price over the exercise price of the options at exercise. As a result, for companies that issue nonqualified stock options to employees, the net cost of outstanding options to common shareholders is the fair value of options minus the expected amount of tax benefits. To incorporate the tax benefits into the measure of *OESO*, I assume that all outstanding options give rise to a tax deduction, and that all firms have a constant 35% tax rate. Therefore, the fair value of outstanding options per share, or *OESO*, is computed as the fair value of total outstanding options multiplied by (1 – 0.35) and divided by the number of common shares outstanding.[32]

4.1.3 Two-Stage Least Squares Estimation

In equations (4.1) and (4.2), stock price and option price are two simultaneously determined endogenous variables. Specifically, stock price is one of the inputs to the Black-Scholes model, while the value of outstanding options

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includes these variables. The FASB's approach is likely to be more useful in practice because it is easy to implement and the information needed is available in firms' financial statements.

affects stock price after controlling for book value and expected future residual earnings. In addition to outstanding employee options, stock option expense is potentially an endogenous variable as well. Stock option expense under SFAS No. 123 is based on the fair value of options on date of grant. As a result, stock option expense depends on the grant date stock price, which is highly correlated with the dependent variable *P*, stock price at the end of the third month after the fiscal year. Since stock price and option price are determined simultaneously, a change in the error term will change both variables. In other words, the independent variables in equation (4.1), *OESO* and *FESO*, are correlated with the disturbance terms ε, resulting in biased ordinary least squares (OLS) estimators. Following previous research, I use the instrumental variables approach, specifically the two-stage least squares method, to estimate the model.[33]

In the first stage, the variables *OESO* and *FESO* are regressed on a set of exogenous variables from equations (4.1) and (4.2) that are expected to be correlated with *OESO* and *FESO* but uncorrelated with the error in equation (4.1). The first stage regression equations are specified as follows:

$$OESO_{jt} = a_0 + a_1 d_{jt} + a_2 T_{jt} + a_3 r_{jt} + a_4 \sigma_{jt} + a_5 OUT_{jt} + a_6 BV_{jt} + a_7 RI_{jt+1} + a_8 RI_{jt+2} + a_9 RILTG_{jt} + \varepsilon_{jt}, \quad (4.3a)$$

$$FESO_{jt} = a_0 + a_1 Fd_{jt} + a_2 FT_{jt} + a_3 Fr_{jt} + a_4 F\sigma_{jt} + a_5 GRANT_{jt} +$$

[32] The regression results based on the fair value of outstanding options not adjusted for tax benefits are discussed in section 4.5.4.

[33] The two-stage least squares method is used in Aboody (1996) and Aboody, Barth and Kasznik (2001). See, for example, Greene (1993) for discussions on the simultaneous equations model and the proof of the consistency of the two-stage least squares estimator.

$$a_6 VEST_{jt} + a_7 BV_{jt} + a_8 RI_{jt+1} + a_9 RI_{jt+2} + a_{10} RILTG_{jt} + \varepsilon_{jt}. \quad (4.3b)$$

In equation (4.3a), the variables d, T, r and σ are the inputs used to compute the Black-Scholes value for outstanding employee options. These variables are estimated using information available on the valuation date, with the estimation procedure described earlier for equation (4.2). *OUT* is the number of employee options outstanding as a percentage of common shares outstanding. In equation (4.3b), the variables *Fd*, *FT*, *Fr* and *Fσ* are the inputs used by companies to determine the fair value of options at grant date. These variables are required to be disclosed in financial statements along with stock option expense.[34] The variable *GRANT* is the number of options granted during the year as a percentage of common shares outstanding, and *VEST* is the reciprocal of the option vesting period. In the second stage of the two-stage least squares estimation, the fitted values obtained from estimating equations (4.3a) and (4.3b), denoted as *OESO** and *FESO**, are used to replace the original *OESO* and *FESO*, and equation (4.1) is estimated using OLS.

Equations (4.3a) and (4.3b) assume a linear relation between option value and the inputs to the Black-Scholes model. However, option value is a nonlinear function of the inputs. To the extent that the linear specification does not capture the relation between option value and the inputs, it could introduce bias in the estimation.

4.2 Sample Selection

The initial sample consists of S&P 1500 companies, which include the S&P 500, S&P 400 MidCap and S&P 600 SmallCap firms. I hand collected data related to employee stock options for these companies from their 1997 and 2000 10-K reports. Each 10-K report contains stock option information for the most recent three years, generating a sample period from 1996 to 2000.[35] Table 1, panel A, summarizes sample selection for the regressions described in section 4.1. For an observation to be included in the sample, the firm must have the following information available in the footnotes to its financial statements: pro forma earnings as required by SFAS No. 123, the number and weighted average exercise price of employee options outstanding, the number of options granted to employees during the year, option vesting period, weighted average remaining life of outstanding options, and inputs to the option pricing model used to determine stock option expense (i.e., expected stock price volatility, expected option life, risk-free interest rate, and dividend yield). In addition, the firm must have market data, other financial statement data, and consensus analyst forecasts from CRSP, COMPUSTAT and I/B/E/S, respectively. In order to control for outliers, I remove 55 observations that have a studentized residual absolute value greater

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[34] The estimated input variables (d, T, r, and σ) and the inputs disclosed by companies (Fd, FT, Fr, and $F\sigma$) are highly correlated, as discussed in section 4.3.

[35] SFAS No. 123 became effective for fiscal years beginning after December 15, 1995. For most firms 1996 is the first year for which stock option expense data are available. A small number of firms also disclose stock option expense for 1995.

than four in regressions (4.3a) and (4.3b), the first stage regressions in the two-stage least squares estimation. The final sample consists of 1,113 firms with 3,677 firm-year observations.

4.3 Descriptive Statistics

Table 2 reports summary statistics on the sample firms' employee option plans. On average, the sample firms have 17.44 million employee options outstanding, which is 8.52% of total outstanding common shares. Each year the sample firms grant an average of 4.94 million options to employees, or 2.68% of outstanding common shares. The outstanding employee options are valued at $314.48 million on average per firm, or 4.45% of a firm's market capitalization. The number and value of outstanding employee options vary greatly across firms, with distributions skewed to the right as is evidenced by the high value of means relative to the medians. Nonetheless, the statistics in general demonstrate that employee stock options account for a substantial portion of companies' outstanding common shares, and their values are not inconsequential to common shareholders.

Table 2 also reveals some characteristics of employee options. The mean Black-Scholes value per option outstanding is $13.22, compared with mean stock price per share of $27.85, mean grant date fair value per option of $10.54 and mean strike price per outstanding option of $18.43. The average price-to-strike ratio is 1.87, indicating that employee options outstanding are on average "in the

money" during the sample period. Employee options on average have 9.72 years of contractual life, while the mean expected life for newly granted options (*FT*) is 5.70 years. This is consistent with the expectation of early exercise. The mean remaining contractual life of outstanding employee options is 7.08 years, which is greater than the mean remaining expected life (*T*) of 3.06 years.

Summary information for the input variables to option pricing models is also reported in Table 2. The estimated value of the inputs (i.e., d, T, r, and σ) and the value disclosed by firms (i.e., Fd, FT, Fr, and $F\sigma$) are close in terms of magnitude and distribution except that the disclosed expected life of newly granted options (*FT*) is greater than the estimated expected life of outstanding options (*T*). Untabulated results show that the estimated inputs are significantly correlated with the inputs disclosed by firms, with correlation coefficients between d and Fd, T and FT, r and Fr, σ and $F\sigma$ of 76.8%, 78.7%, 29.5%, and 85.4%, respectively.

Table 3 presents descriptive statistics for variables used in regression (4.1). Stock option expense per share, *FESO*, is computed as reported earnings minus pro forma earnings disclosed under SFAS No. 123 and divided by number of shares outstanding at fiscal year end. The mean (median) of *FESO* is 0.08 (0.05), compared to the (untabulated) mean (median) of reported EPS of 1.31 (1.12). Thus, on average stock option expense represents 6% of net income, suggesting that the sample firms incur economically significant costs associated

with option compensation. The mean (median) of outstanding employee stock options per common share after adjusted for tax benefits, *OESO*, is 0.72 (0.45).[36] Table 3, panel B indicates that the correlation coefficient between price and *FESO* (*OESO*) is 0.13 (0.44), both statistically significant. In contrast, the correlation coefficient between price and *FESO** is insignificantly (0.02), and significantly negative (–0.05) between price and *OESO**. The results are consistent with a cross-sectional negative relation between share price and *OESO* after controlling for the positive effects of price on option value.

4.4 Results

Table 4 presents regression results based on the two-stage least squares estimation. The table presents results for four model specifications. Model 1 is based on the standard residual income model and does not include the stock option variables. Models 2 and 3 add one of the stock option variables to model 1. Model 4 represents the primary regression model, with both stock option variables included as specified in equation (4.1). I include year indicator variables in all models to control for the variation of market-wide effects over different years.

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[36] Summary statistics for the fitted value of *FESO* and *OESO*, denoted as *FESO** and *OESO**, are also presented in panel A of table 3. The fitted values of *FESO* and *OESO* are obtained from estimating equations (4.3a) and (4.3b) using OLS, therefore by construction mean *FESO** (*OESO**) is equal to mean *FESO* (*OESO*). Panel A of table 3 reveals small differences between the numbers, which is due to the deletion of observations that have a studentized residual absolute value greater than four in regressions (4.3a) and (4.3b). The adjusted R^2s from estimating equations (4.3a) and (4.3b) are 30% and 34%, respectively (untabulated).

Consistent with predictions and prior research, the regression results reported in table 4 indicate that share price is positively related to current book value (*BV*), expected two-year-ahead residual earnings (RI_{t+2}), and expected long term earnings (*RILTG*) in all four specifications. The coefficients on one-year-ahead residual earnings (RI_{t+1}), however, are significantly negative and therefore inconsistent with expectations. One possible reason for the negative coefficients on RI_{t+1} is the multicollinearity problem due to the high correlation between RI_{t+1} and RI_{t+2}. More analysis on this issue is presented in section 4.5.2.

Table 4 reveals that, the coefficient on *FESO** (*OESO**) is significantly negative in model 2 (3). In addition, the coefficients on *FESO** and *OESO** remain significantly negative when both variables are included in model 4. The coefficients on *FESO** and *OESO** in model 4 are –10.92 and –1.63, respectively. The results are consistent with the modified residual income model in which share price is negatively affected by both outstanding employee options and expected stock option expense, after controlling for current book value and future residual earnings. The evidence corroborates the findings from two prior studies, specifically Aboody (1996) who finds a negative relation between stock price and outstanding employee option value, and Aboody, Barth and Kasznik (2001) who find a negative relation between stock price and stock option expense disclosed under SFAS No. 123.

Results from additional hypothesis tests (untabulated) indicate that the coefficient on *OESO** in model 4 is not significantly different from –1 (t-statistic = –1.21), consistent with expectations. There is some evidence that omitting *OESO** (*FESO**) in the model causes the estimated coefficient on *FESO** (*OESO**) to be biased upward in absolute magnitude. The coefficients on *OESO** and *FESO** become smaller in magnitude when both variables are included in model 4. In addition, the coefficient on *OESO** in model 3 is significantly different from –1 (t-statistic = –3.97).

4.5 Additional Analysis

4.5.1 Results from Ordinary Least Squares (OLS) Estimation

For comparison purpose, I report the regression results based on OLS estimation in table 5. Consistent with the results reported in table 4, share prices are positively related to *BV* and RI_{t+2} and negatively related to RI_{t+1} in all four specifications. However, different model specifications appear to have significant effects on the estimated coefficient on *RILTG*, which is significantly positive in models 1 and 2 and becomes significantly negative in models 3 and 4. Contrary to the results in table 4, the coefficients on *FESO* and *OESO* are significantly positive in models 2 and 3, respectively. Model 4 reveals that, when both *FESO* and *OESO* are included in the model, the coefficient on *OESO* remains

significantly positive, while the coefficient on *FESO* becomes significantly negative.

Overall, the results in table 5, when compared with those in table 4, are consistent with the existence of the simultaneous equation problem. The significantly positive relation between stock price and *OESO* in models 3 and 4 is consistent with option value being a positive function of the price of the underlying stock. The significantly positive coefficient on *FESO* in model 2 and significantly negative coefficient on *FESO* in model 4 are consistent with an omitted correlated variable that causes biased estimators for the coefficient on *FESO*.

4.5.2 Expected Future Residual Earnings

The results in table 4 indicate that the estimated coefficients on the one-year-ahead residual earnings, RI_{t+1}, are significantly negative. The negative coefficients, however, could be caused by the multicollinearity problem. This section provides more analysis on this issue.

For my sample firms, the forecasted one-year-ahead and two-year-ahead earnings are highly correlated, with a Pearson (Spearman) correlation coefficient of 98% (98%). The two corresponding residual earnings, RI_{t+1} and RI_{t+2}, are also highly correlated, with a Pearson (Spearman) correlation coefficient of 95% (96%). The high correlation between RI_{t+1} and RI_{t+2} could lead to a multicollinearity problem when both are included in a regression. In order to

provide evidence on this issue, I re-estimate the models including either RI_{t+1} or RI_{t+2} (but not both) in the regressions, and report the results in table 6. The results in panel A of table 6 reveal that, when only RI_{t+1} (but not RI_{t+2}) is included in the regressions along with other variables, the coefficients on RI_{t+1} are significantly positive in all four models, which is consistent with expectations. Similarly, when only RI_{t+2} (but not RI_{t+1}) is included in the regressions, as shown in panel B, the coefficients on RI_{t+2} are significantly positive in all four models.

In addition, excluding either earnings variable from the regressions does not have a significant effect on the estimated coefficients on other variables of the models. Similar to the results in table 4, the coefficients on *FESO** and *OESO** are significantly negative in model 4 in both panels A and B. In addition, the coefficients on *OESO** in model 4 are not significantly different from –1, with t-statistics (untabulated) of –1.42 and –1.20 in panel A and B, respectively. Furthermore, adjusted R^2s of the models are very close to those in table 4.

In sum, all evidence suggests that the two earnings forecasts contain essentially the same information. The findings support that the negative coefficients on RI_{t+1} as reported in table 4 are consistent with evidence of multicollinearity due to the high correlation between the two earnings terms.

4.5.3 Expected Stock Option Expense

The results reported in table 4 are based on current stock option expense that is used to proxy for expected future stock option expense. Additional

analysis is conducted to examine the robustness of the results to alternative proxies for future option expense. First, I assume stock option expense grows at the rate equal to analyst forecasts of long term growth rate of earnings.[37] Thus, expected option expense is computed as current option expense multiplied by one plus the forecasted long term earnings growth rate. The results are presented in panel A of table 7.[38] In general, the results are similar to those in table 4. The coefficients on *FESO** and *OESO** are significantly negative in model 4, and the coefficients on *OESO** in model 4 are not significantly different from –1 (t-statistic = – 1.10, untabulated).

The second alternative proxy is the fair value of total options granted during the year. Under SFAS No. 123, stock option expense is determined by amortizing the grant date fair value of options over their vesting periods. Therefore, stock option expense for a particular year is typically not equal to the value of options granted during that year. The fair value of options granted during the year is computed as the weighted average grant date fair value per option times the number of options granted during the year.[39] Regression results, reported in panel B of table 7, indicate that the inferences relating to the stock options variables remain unchanged. The estimated coefficients on *FESO** and

[37] I also estimate the models assuming that stock option expense grows at the same rate as one-year-ahead expected earnings. In other words, stock option expense as a percentage of earnings is assumed to be the same in future years. The results are very close to those reported in panel A of table 7.

[38] Since the regression results for models 1 and 3 are identical to those reported in table 4, I only report the results for models 2 and 4 in table 7.

*OESO** in model 4 are significantly negative. The coefficient on *OESO** is insignificantly different from – 1 in model 4 (t-statistic = – 1.36, untabulated). The notable change in panel B of table 7, when compared with table 4, is the magnitude of the coefficients on *FESO**. Specifically, in model 4, the coefficient on *FESO** decreases in absolute magnitude from –10.92 in table 4 to –2.76 in panel B of table 7. The results suggest that stock option expense computed based on the fair value method under SFAS No. 123 is more strongly related to stock prices than the fair value of options granted during the year.

4.5.4 Tax Benefits of Employee Stock Options

As discussed in section 4.1.2, employee stock options are classified into two types of options for tax purposes, and only nonqualified stock options give rise to a tax deduction. For companies that issue nonqualified stock options, tax benefits reduce the cost of outstanding stock options to shareholders and should be taken into account when estimating the potential dilution caused by outstanding stock options. The regression results discussed so far are based on the measure of *OESO* that accounts for tax benefits with the assumption that all options give rise to a tax deduction. In order to test the sensitivity of the results to this assumption, I re-estimate the regressions in table 4 replacing *OESO* with *OESO'*, which is measured as the fair value of options outstanding without adjusted for tax benefits. The results are reported in table 8. In general the

[39] Both variables are required to be disclosed under SFAS No. 123.

inferences relating to the coefficients on *FESO** and *OESO'** are similar to those in table 4. The coefficient on *OESO'** decreases in absolute magnitude, from –1.63 in table 4 to –1.06 in table 8. The coefficient on *OESO'** is insignificantly different from – 1 (t-statistic = –0.17, untabulated).

4.5.5 Analyst Forecasts of Diluted EPS versus Basic EPS

The modified residual income model developed in chapter 3 (equation (3.5)) is specified on a total value basis, while the regression model (equation (4.1)) is on a per share basis. Equation (3.5) can be transformed into a per share basis equation by dividing all variables in the model by the number of outstanding common shares. Hence, the variable on the left hand side of the model (the market value of total common shares, or V_t^S) becomes stock price per share (P_t), which is the dependent variable in the regression model. Ideally, all variables on the right hand side of the regression model should also be on a per common share basis. Among the six independent variables, *BV*, *FESO*, and *OESO* are computed by dividing the total dollar amount by the number of outstanding common shares, and therefore satisfy the requirement. The computation of expected residual earnings per share (RI_{t+1}, RI_{t+2} and *RILTG*), however, involves the use of analyst EPS forecasts. Most of the analyst forecasts made prior to December 15, 1997 are forecasts of "primary" EPS, and most forecasts made after that date are forecasts

of "diluted" EPS.[40] Both measures of EPS reflect to some extent the potential dilution of earnings in the interest of current shareholders caused by outstanding dilutive securities. Although these two measures differ in certain ways (e.g., in the treatment of convertible securities), they both use the treasury stock method to calculate dilution caused by outstanding stock options.[41]

Consequently, the computation of RI_{t+1}, RI_{t+2} and *RILTG* involves variables that are measured on different bases. For example, the computation of RI_{t+1}, which is equal to analyst forecast of one-year-ahead EPS minus beginning book value times cost of capital, involves EPS forecasts measured on the diluted basis and book value per share measured on the per common share basis. The problem associated with the calculation of RI_{t+1}, RI_{t+2} and *RILTG* also causes inconsistency between these variables and other independent variables in the regression model that are measured on the per common share basis. In order to examine the effect of this inconsistency on the regression results, I provide additional analysis with an attempt to reduce this inconsistency.

The I/B/E/S database provides "dilution factors" for EPS forecasts, which are computed as the ratio of basic EPS to diluted EPS, both from previous year's

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[40] SFAS No. 128, which is effective for fiscal years ending after December 15, 1997, requires companies to report "basic" EPS and "diluted" EPS, replacing the "primary" EPS and "fully diluted" EPS reported under previous standard. In my sample, for observations with information about the basis on which forecasted EPS is reported available in I/B/E/S, about 60% of forecasts made prior to December 15, 1997 are "primary" EPS and about 95% of forecasts made after that date are "diluted" EPS.

[41] As discussed in section 2.2.3, Core et. al (2002) show that the treasury stock method understates the economic dilution of outstanding stock options.

financial statements.[42] Therefore, the "diluted" EPS forecasts are converted into "basic" EPS forecasts by multiplying the forecasts by the dilution factors.[43] I re-estimate the regressions in table 4 replacing RI_{t+1}, RI_{t+2} and *RILTG* with RI'_{t+1}, RI'_{t+2} and *RILTG'*, which are computed based on the converted basic EPS forecasts, and report the results in table 9. Consistent with the results in table 4, the estimated coefficients on *FESO** and *OESO** are significantly negative. The coefficient on *OESO** in model 4, although increases in absolute magnitude from –1.63 in table 4 to –1.80 in table 9, remains insignificantly different from –1 (t-statistic = – 1.54, untabulated). Thus, converting analyst forecasts of diluted EPS into basic EPS does not have a significant effect on the regression results.

[42] In I/B/E/S, the basis on which EPS forecasts are reported is determined by the basis of EPS used by the majority of analysts. When an analyst reports an EPS forecast on a basis that is different from the one used by the majority of analysts, the forecast is converted into the populous basis using the dilution factor. I/B/E/S also provides "dilution indicators" which indicate the basis on which the consensus forecasts are reported.

[43] For my sample of 3,677 observations, 875 observations (or 24% of the total sample) do not have dilution factors and dilution indicators available. For these observations, I assume they are reported on the "basic" EPS basis, and thus no conversion is required. Regression results based on observations with dilution factors and dilution indicators available are very close to those reported in table 9.

Chapter 5: Information Content of SFAS No. 123 Disclosures

The results presented in chapter 4 indicate that there is a significant association between stock prices and both the fair value of outstanding employee options and expected stock option expense. However, it remains unclear whether investors actually use the information disclosed under SFAS No. 123. In this section, I examine whether SFAS No. 123 footnote disclosures communicate useful information about employee stock options to investors. To do this, I test for a market response to the disclosures of information about stock option expense as required by SFAS No. 123 when firms file their 10-Ks with SEC. The remainder of this chapter discusses disclosures of information about stock option compensation, and then presents the research design and findings of the empirical investigation of the market's response to SFAS No. 123 disclosures.

5.1 Information about Stock Option Compensation

There are a variety of sources where investors can obtain information about a firm's stock option plans. The SEC and the national stock exchanges require shareholder approval of stock option plans in which directors and officers participate.[44] Information about proposed stock option plans is provided in proxy

[44] The New York Stock Exchange (NYSE) exempt "broadly-based" stock plans from the requirement of shareholder approval. A plan would qualify as broadly-based if at least 20 percent of the company's employees are eligible to receive options and at least half of those eligible under the plan are neither officers nor directors. The rule has been criticized by many shareholder

statements which are available to shareholders before voting takes place. In addition, as a result of the SEC's expansion of executive compensation disclosure requirements in 1992, companies' annual proxy statements must provide detailed information on salary, bonus, option grants, restricted stock awards as well as total option and share ownership for the company's chief executive and the next four highest-paid officers.[45]

Although information regarding a firm's stock option plans, particularly its executive option grants, may become available to investors through proxy statements and insider trading SEC filings, there is no requirement of systematic disclosures of information about firm-wide option plans prior to the release of financial statements. As the use of stock option compensation for non-executive employees has grown rapidly in recent years, broadly-based plans have become a significant component of a firm's option plans.[46] In addition, since companies are not required to disclose detailed stock option information in quarterly financial statements, annual financial statements represent the only official disclosures of stock option expense under the fair value method. Therefore, annual financial statements are likely to be an important source of information about a firm's employee option plans and stock option activities.

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groups who believe no option plan should be exempted from shareholder approval. The NYSE is currently considering changes to its shareholder approval rules (NYSE, 2000).

[45] A publicly traded company must file an annual proxy statement with the SEC within 120 days after the end of the fiscal year and must mail proxies to every shareholder before its annual shareholders meeting.

5.2 Research Design

5.2.1 The 10-K Filing Interval

To determine whether annual financial statement disclosure of stock option information is used by investors, I examine the association between unexpected stock option expense and unexpected stock returns cumulated over a three-day interval surrounding the dates when firms file their 10-Ks with the SEC through the EDGAR system.[47] The stock option expense as measured using the fair value method is arguably the key variable presented in the SFAS No. 123 footnotes. As indicated in equation (3.5) and (3.6), an increase in current stock option expense may lead to an increase in expected future stock option expense, which will result in a decrease in expected future residual earnings and a decrease in firm value. Therefore, I hypothesize that changes in stock option expense are negatively correlated with unexpected returns around the filings of firms' 10-Ks.

The test for an association between change in stock option expense and unexpected stock returns at disclosure of financial statements is conducted with the following regression models:

$$CAR10K_{jt} = a_0 + a_1 \Delta ESOEXP_{jt} + a_2 UE_{jt} + \sum b_i Y_i + \varepsilon_{jt}, \qquad (5.1a)$$

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[46] Core and Guay (2000) reports that non-executive employees hold 67% of total options outstanding for their sample firms with option plans during 1994 – 1997.

[47] Starting in 1996, the SEC requires all public domestic firms to make their filings, including the 10-K reports, through the EDGAR system. The 10-K report is required to be filed with the SEC within 90 days after the end of the fiscal year. The "filing date" refers to the date on which the SEC receives the 10-K reports. These reports are typically available to the public the day after they are received.

$$CAR10K_{jt} = a_0 + a_1\Delta ESOEXP_{jt} + a_2 UE_{jt} + a_3\Delta GP_{jt} + a_4\Delta SGA_{jt} + a_5\Delta DEPAMT_{jt} + a_6\Delta INTEXP_{jt} + a_7\Delta RD_{jt} + a_8\Delta OTHER_{jt} + \sum b_i Y_i + \varepsilon_{jt}, \quad (5.1b)$$

where:

$CAR10K_{jt}$: cumulative market adjusted return for the three-day period starting the day before a firm's filing of 10-K for fiscal year t; market adjusted return is firm *j*'s raw daily return less the CRSP equally-weighted market return;

$\Delta ESOEXP_{jt}$: change in stock option expense per share deflated by share price at the end of fiscal year *t*; stock option expense is calculated as earnings minus pro forma earnings disclosed under SFAS No. 123;

Y_i: year indicator variable; Y_i equals one for year *i* and zero otherwise, where *i* is from 1997 to 1999;

UE: unexpected EPS deflated by share price at the end of fiscal year *t*, where unexpected EPS is the difference between actual EPS and analysts' EPS forecast, both obtained from I/B/E/S, with analysts' EPS forecasts made in the month before earnings announcement month;

ΔGP: change in gross profit per share deflated by share price at the end of fiscal year *t*, where gross profit is equal to sales minus cost of goods sold;

ΔSGA: change in selling, general and administrative expense per share deflated by share price at the end of fiscal year *t*;

$\Delta DEPAMT$: change in depreciation and amortization per share deflated by share price at the end of fiscal year *t*;

$\Delta INTEXP$: change in interest expense per share deflated by share price at the end of fiscal year *t*;

ΔRD: change in research and development expense per share deflated by share price at the end of fiscal year *t*;

ΔOTHER: change in other expense per share deflated by share price at the end of fiscal year *t*, where other expense is equal to *GP* minus *SGA*, *DEPAMT*, *INTEXP*, *RD*, and net income.

Equation (5.1a) is the basic model that tests the association between security returns and changes in stock option expense. Unexpected earnings are included to control for post earnings announcement drift that has been documented in prior studies (see, e.g., Bernard and Thomas 1989, 1990). I also include year indicator variables to control for the variation of market-wide effects over different years. Equation (5.1b) includes controls for other information conveyed by 10-Ks that may potentially be useful for investors in their assessments of firm value. Prior studies have shown that earnings components provide incremental explanatory power for security returns after controlling for earnings (see, e.g., Lipe 1986). Since earnings component information might not be available to investors until the release of the full financial statements, I identify major components of reported earnings and include them in the regression as control variables.

I expect the coefficient on unexpected stock option expense to be negative in both specifications. Because no analyst forecast of stock option expense is available and because there are not sufficient data to estimate its time-series properties, I use stock option expense in the previous year as a proxy for market expectations. To the extent that change in stock option expense is a noisy proxy

for unexpected stock option expense, it could potentially bias against finding a significant relation.[48]

5.2.2 Two Alternative Intervals

In addition to the return interval at 10-K filings, I also examine two alternative intervals to test whether stock option information is already anticipated prior to 10-K filings. First, I examine the relation between changes in stock option expense and unexpected stock returns for the period between the earnings announcement and the 10-K filing. The releases of annual financial statements may not provide *new* information about stock option expense if such information is known to the market before disclosures. The leakage of information could occur if companies release annual reports to shareholders before filing the 10-Ks with the SEC.[49] The empirical test is conducted by estimating the following regression model:

$$CARBTW_{jt} = a_0 + a_1 \Delta ESOEXP_{jt} + a_2 UE_{jt} + \sum b_i Y_i + \varepsilon_{jt}, \qquad (5.2a)$$

where $CARBTW_{jt}$ is cumulative market adjusted return for the period beginning the second day after the earnings announcement until two days before the 10-K filing through EDGAR; other variables are as defined for equation (5.1a). A

[48] Employee stock option expense increases over time from 1996 to 2000 which is partially due to the phase-in provisions that only options granted after 1994 are included in stock option expense. Since stock option expense is calculated by amortizing the fair value of option grants over the vesting period, which is usually 3 to 4 years, stock option expense would increase each year until the phase-in period is complete.

negative association is expected if information about stock option expense leaks to the market during this period.

Second, I examine the relation between changes in stock option expense and unexpected stock returns over a three-day period around the earnings announcement date after controlling for unexpected earnings. Companies in general announce earnings before releasing full financial statements. If companies disclose information about stock option expense to the market at earnings announcements, then a negative association between changes in stock option expense and unexpected stock returns is expected.

The purpose of the regression test is to provide evidence on whether firms disclose stock option expense information when announcing earnings. In order to provide more direct evidence on this issue, I randomly select 50 firm-year observations from the final sample, and for each of the 50 firms, I collect the earnings announcement press release for the chosen year from the Lexis-Nexis newswire archives. I read all 50 earnings press releases and find that none of the press releases disclose any information related to stock option compensation.[50] To the extent that the finding can be generalized to the whole sample, it suggests that information about stock option expense is generally not available to the

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[49] The filing of annual reports through EDGAR is voluntary. I am not able to conduct an event study for the release of annual reports because it is not feasible to identify the event dates.

[50] Among the 50 earnings press releases, 4 companies briefly mentioned their share repurchase programs, one of which stated that the purpose of share repurchases was for employee stock option exercises.

market at earnings announcements.[51] As a result, I do not expect an association between changes in stock option expense and unexpected stock returns at earnings announcements.

The empirical test is conducted by estimating the following regression model:

$$CAREA_{jt} = a_0 + a_1 \Delta ESOEXP_{jt} + a_2 UE_{jt} + \sum b_i Y_i + \varepsilon_{jt}, \quad (5.2b)$$

where $CAREA_{jt}$ is cumulative market adjusted return for the three-day period starting the day before earnings announcement; other variables are as defined for equation (5.1a).

5.3 Sample Selection

Panel B of table 1 summarizes sample selection for the tests of the association between market reaction and the release of stock option expense information. The primary sample is the same as those used for the regressions described in chapter 4 with some differences in sample selection criteria. For an observation to be included in sample year t, the firm must have stock option expense for years t-1 and t. The firm's 10-K filing date must appear on the EDGAR website. In addition, the firm must have an earnings announcement date on COMPUSTAT, daily returns from the day before earnings announcement through the day after 10-K filing, share price and the number of common shares

[51] The result is not surprising given the fact that most companies opposed the proposed recognition of stock option expense with the fear that such recognition would hurt their stock

outstanding at fiscal year end on CRSP, and a consensus analyst earnings forecast in the I/B/E/S database for the month before the earnings announcement month. The 10-K filing date must be at least three trading days away from earnings announcement date for a sample year. The final sample consists of 1,198 firms with 3,438 firm-year observations from 1997 through 2000.[52]

5.4 Descriptive Statistics

Table 10 presents summary statistics for the sample. The mean and median of change in stock option expense scaled by price, *ΔESOEXP*, is 0.002 and 0.001, respectively. Untabulated results shows that the mean (median) return interval for *CARBTW* is 31 (32) days, with a maximum (minimum) of 101 (1) days. Panel B of table 10 reveals that, as predicted, unexpected returns around the filing of 10-Ks are significantly negatively correlated with changes in stock option expense. The simple correlation coefficient between *CAR10K* and *ΔESOEXP* is – 0.044. In contrast, *ΔESOEXP* is not significantly correlated with *CARBTW* and *CAREA*. Both correlation coefficients are positive, but neither is significant. Overall the statistics are consistent with the notion that information

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prices.

[52] All of the 3,438 firm-year observations have gross profits (i.e., sales and cost of goods sold) available on COMPUSTAT. If the expense variables in equation (5.1b) were not available from COMPUSTAT, I set their values equal to zero. I also estimate model (5.1b) using observations that have all expense variables available. Results for this sample are qualitatively similar to the results reported in table 12.

concerning a firm's stock option expense is not revealed to the market until the release of the full financial statements.

5.5 Results

Table 11 presents the results from estimating equations (5.1a) and (5.1b), which are referred to as models 1 and 2 in the table. Consistent with predictions, the coefficient on *ΔESOEXP* is significantly negative in model 1. The coefficient remains significantly negative in model 2. The coefficient estimates (t-statistics) are –0.309 and –0.343 (–2.270, –2.490) in models 1 and 2, respectively. Adding control variables to the basic model appears to have little effect on the magnitude and statistical significance of the estimated coefficient on *ΔESOEXP*. The coefficient on unexpected earnings in model 1 and the coefficients on all control variables in model 2 are not significantly different from zero. Table 11 also reveals that both specifications have adjusted R^2s of about 1%, indicating that changes in stock option expense explain only a small portion of the variation of stock returns surrounding the filings of 10-Ks with the SEC.

To test whether information about stock option expense leaks to the market before the filings of 10-Ks through EDGAR, I estimate models (5.2a) and (5.2b) and report the results in table 12, panels A and B, respectively. In contrast to the results in table 11, panel A of table 12 reveals that, for the interval between earnings announcement and 10-K filing, the coefficient on *ΔESOEXP* is

insignificant.[53] The coefficient on unexpected earnings is also insignificant. The results do not support a leakage of information about stock option expense prior to the filing of 10-Ks with the SEC.

Panel B of table 12 reports the regression results for the earnings announcement interval. Consistent with prior research, the coefficient on unexpected earnings is positive and significant. The coefficient on *ΔESOEXP* is insignificant. The results, consistent with findings from the 50 randomly selected earnings press releases, suggest that on average information about stock option expense is not available to investors when firms announce annual earnings. In sum, the results in table 12 provide supporting evidence on the communication value of the disclosures of annual financial statements at 10-K filings.

5.6 Additional Analysis

In order to examine the effects of observations with extreme value on the results regarding the association between unexpected stock option expense and unexpected stock returns, I re-estimate the regressions in table 11 restricting the magnitude of *ΔESOEXP* to be less than 0.1. Twelve observations are eliminated due to this restriction. Untabulated results indicate that the estimated coefficients (t-statistics) on *ΔESOEXP* are –0.627 and –0.672 (–3.500 and –3.730) in models 1 and 2, respectively. Since both coefficients remain significantly negative, the

[53] I also re-estimated model (5.1b) using *CARBTW*. The results (untabulated) indicate that the

inferences regarding the association between unexpected stock option expense and unexpected stock returns remain unchanged. The increase in magnitude of the estimated coefficients is consistent with evidence of a nonlinear relation between unexpected returns and unexpected stock option expense.

I also re-estimate models 1 and 2 in table 11 with firm size, book-to-market and leverage included to control for their effects on security returns. The magnitude and statistical significance of the coefficients on *ΔESOEXP* are not significantly affected.

In sum, the findings discussed in section 5.5 and 5.6 indicate that the release of annual financial statements provides useful information concerning a firm's stock option plans to investors. It also suggests that stock option expense calculated based on the SFAS No. 123 methodology is viewed as sufficiently reliable to be used in firm valuation. The evidence does not support the view, raised by opponents to the FASB's 1993 exposure draft, that stock option compensation expense cannot be reliably measured. An advantage of using a short window return study is that it reduces the possibility of econometric problems, such as the simultaneous equation problem and the omitted variable problem. Together with the results discussed in chapter 4, the findings support the conclusion that investors recognize to some extent the expense associated with stock option compensation, and that disclosure of the information contained in

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coefficient on *ΔESOEXP* and all other explanatory variables remains insignificant.

SFAS No. 123 footnotes conveys useful information about employee stock options that investors use to revise their expectations about future stock option expense.

Chapter 6: Summary and Conclusions

This study provides a theoretical analysis and empirical investigation of the valuation implications of employee stock options. First, a modified residual income model is developed for stock valuation in the presence of employee stock options. The model identifies two distinct roles of employee stock options in valuation: current outstanding employee options and stock options expected to be issued to compensate employees in future periods. The value obtained from traditional residual income models must be adjusted for the value of outstanding options. In addition, the value of expected future employee options must be explicitly incorporated into the traditional residual income models when firms do not expense the fair value of options in net income (when the intrinsic value method is used). Such adjustment is not required when firms recognize stock option expense (when the fair value method is used). Additional analysis is provided to show that the modified residual income model is consistent with the conventional view of residual income framework regarding the effects of different accounting choices on stock valuation.

Based on the analytical results, empirical tests are conducted to provide evidence on whether the effects of employee stock options are reflected in share prices. To examine this issue, I use hand-collected data related to outstanding employee options and stock option expense for S&P 1500 companies from their

10-Ks. The results support the existence of a cross-sectional negative association between share prices and both outstanding employee options and stock option expense, after controlling for book value, expected future residual earnings and long term earnings growth. The findings are consistent with the modified residual income model in which outstanding employee options and stock option expense have distinct valuation effects. The coefficient on outstanding employee options is insignificantly different from –1, consistent with the predictions from the modified residual income model. I also provide some evidence that omitting one stock option variable in the model biases the estimator for the other stock option variable.

In addition to the association tests for the relation between share prices and information about employee options, I conduct an event study which provides evidence that the release of annual financial statements provides useful information to investors concerning a firm's stock option expense. Specifically, I find a negative association between unexpected stock returns and changes in stock option expense disclosed under SFAS No. 123 around firms' 10-K filings with the SEC. In contrast, I find no significant association between unexpected stock returns and changes in stock option expense over a three-day interval around earnings announcement dates, or for the period between earnings announcements and 10-K filings. Taken together, the results from both the association study and the event study suggest that investors adjust share prices for the potential dilution

caused by outstanding employee options, and recognize to some extent the compensation expense associated with stock option compensation.

With the extensive use of stock option compensation by U.S. corporations, it has become increasingly important to incorporate the impact of employee stock options when estimating firm value. This study provides important insights about the valuation implications of employee stock options. The empirical results of this study suggest that the SFAS No. 123 stock option footnotes provide useful information for investors to estimate the effects of employee options on common equity value. However, allowing companies to disclose stock option expense in the footnotes rather than requiring them to recognize the expense in net income delays the incorporation of information into stock price, because financial statements are typically released after earnings are announced. Moreover, because reported earnings do not reflect the expense associated with stock option compensation, the ability of reported earnings to provide information about future cash flows is reduced. The analysis in this study suggests that pro forma earnings disclosed under SFAS No. 123 represent a more appropriate measure of earnings for valuation purposes. Currently, information about pro forma earnings under SFAS No. 123 is required to be disclosed in annual financial statements. The findings in this study support the calling for extending the disclosure requirements to quarterly financial statements.

This study also has implications for accounting research that examines the relation between equity values and accounting information in the residual income valuation framework. Specifically, this study suggests that the effects of employee stock options should be incorporated in regressions that are based on the residual income model. Omission of the effects of employee stock options can potentially lead to incorrect inferences about variables of interests when these variables are associated with firms' use of stock option compensation.

Appendix A

This appendix examines the implications of anticipated future issuance of common stock and employee stock options for valuation using the residual income model. The goal is to justify algebraically the subtraction of expected future employee stock options from the traditional residual income model when options are expected to be accounted for using the intrinsic value method. The analysis also explains why such subtraction is not required for anticipated common share issues, or for anticipated employee stock option issues that are accounted for using the fair value method.

The appendix presents the traditional residual income model under four different scenarios. Scenario 1 is the benchmark scenario for a firm that is not expected to issue common shares or employee options in any future periods. Under scenario 2, the firm is expected to issue *common shares* at the end of future period $t + j$. Under scenario 3, the firm is expected to issue *stock options* to compensate employees at the end of future period $t + j$, and use the intrinsic value method to account for employee options. Scenario 4 is similar to scenario 3 except that the firm uses the fair value method. No security issuance is expected in other future periods under scenarios 2 to 4. I also make the following assumptions to ensure that the anticipated issuance of common shares or stock options is not expected to create value for common shareholders. First, under

scenario 2, proceeds from share issues are expected to earn the required cost of capital. Second, under scenarios 3 and 4, cash salaries are expected to be reduced by the amount equal to the fair value of options issued to employees. Third, under scenarios 3 and 4, the cash savings from salary reduction are expected to earn the required cost of capital. Fourth, stock option compensation is not expected to affect employee behavior (in other words, stock options have no incentive effects). Under these assumptions, the value of common stock is the same under all four scenarios. Furthermore, to simplify the analysis, I assume that there are no employee stock options or other contingent equity claims outstanding at time *t*.

Theoretically, the residual income model should produce the same value for common stock under all four scenarios. I first present the residual income model for scenario 1. Because no future security issuance is expected in scenario 1, the value obtained from the traditional residual income model is equal to the value of common stock. I then use it as a benchmark to evaluate the values obtained from the traditional residual income models under scenarios 2 to 4.

Scenario 1: Valuation of common stock with no expected issuance of common stock or stock options in any future periods

Let V_t^{E1} denote the value obtained from the residual income model in scenario 1. In addition, let NI_t and BV_t be earnings and book value under scenario 1. The residual income model can be expressed as:

$$V_t^{E1} = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i}, \qquad \text{(A1)}$$

where r is cost of equity capital (assumed constant) and $E_t[.]$ denotes expectation conditional on information available at time t. As mentioned earlier, because there is no current dilutive security outstanding and no future security issuance expected, the value obtained from the residual income model equals the value of common stock. In other words, $V_t^{E1} = V_t^S$, where V_t^S is the value of common stock.

Scenario 2: Valuation of common stock with an anticipated share issue at the end of future period t + j and no expected security issuance in other future periods

Let S denote the value of common shares issued. In addition, let V_t^{E2}, NI_t^{A2} and BV_t^{A2} be the value obtained from the residual income model, accounting earnings and book value under scenario 2. The value obtained from the residual income model can be written as:

$$V_t^{E2} = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i}^{A2} - r * BV_{t+i-1}^{A2}\right]}{(1+r)^i}$$

$$= BV_t + \sum_{i=1}^{j} \frac{E_t[NI_{t+i} - r * BV_{t+i-1}]}{(1+r)^i} + \frac{E_t[NI_{t+j+1}^{A2} - r * BV_{t+j}^{A2}]}{(1+r)^{j+1}} +$$

$$\sum_{i=2}^{\infty} \frac{E_t[NI_{t+j+i}^{A2} - r * BV_{t+j+i-1}^{A2}]}{(1+r)^{j+i}}$$

$$= BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i}$$

$$= V_t^{E1} \qquad \text{(A2)}$$

Note that for periods $t + 1$ to $t + j$, expected earnings and beginning-of-period book value, and hence expected residual earnings are identical under scenarios 1 and 2. For period $t + j + 1$, expected beginning book value, $E_t[BV_{t+j}^{A2}]$, increases by $E_t[S]$, so $E_t[BV_{t+j}^{A2}] = E_t[BV_{t+j} + S]$. Under the assumption that proceeds of the common share issues are invested in investments earning the required cost of capital r, $E_t[NI_{t+j+1}^{A2}]$ can be written as $E_t[NI_{t+j+1} + r * S]$. Therefore, the residual earnings in period $t + j + 1$ can be rewritten as $E_t[(NI_{t+j+1} + r * S) - r * (BV_{t+j} + S)]$, or $E_t[NI_{t+j+1} - r * BV_{t+j}]$. In other words, the issuance of common shares at the end of period $t + j$ does not affect the residual earnings in period $t + j + 1$. The same reasoning can be applied to all periods after $t + j + 1$. Taken together, expected residual earnings are the

same under scenarios 1 and 2 for all future periods, therefore V_t^{E2} equals V_t^{E1}. In other words, the value obtained from the traditional residual income model equals the value of common stock when future common stock issuance is expected. .

Scenario 3: Valuation of common stock with an anticipated employee stock option issue at the end of period t + j and no expected security issuance in other future periods – intrinsic value method

Let *O* denote the fair value of options issued to employees. In addition, let V_t^{E3}, NI_t^{A3} and BV_t^{A3} be the value obtained from the traditional residual income model, accounting earnings and book value under scenario 3. The value obtained from the residual income model can be written as:

$$V_t^{E3} = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i}^{A3} - r * BV_{t+i-1}^{A3}\right]}{(1+r)^i}$$

$$= BV_t + \sum_{i=1}^{j-1} \frac{E_t[NI_{t+i} - r * BV_{t+i-1}]}{(1+r)^i} + \frac{E_t[NI_{t+j}^{A3} - r * BV_{t+j-1}]}{(1+r)^j} +$$

$$\frac{E_t[NI_{t+j+1}^{A3} - r * BV_{t+j}^{A3}]}{(1+r)^{j+1}} + \sum_{i=2}^{\infty} \frac{E_t[NI_{t+j+i}^{A3} - r * BV_{t+j+i-1}^{A3}]}{(1+r)^{j+i}}$$

$$= BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i} + \frac{E_t[O]}{(1+r)^j}$$

$$= V_t^{E1} + \frac{E_t[O]}{(1+r)^j} \qquad \text{(A3)}$$

Note that expected residual earnings for periods $t + 1$ to $t + j - 1$ are the same under scenarios 1 and 3. For period $t + j$, because the firm is expected to

recognize no option expense and because salary expense is expected to reduced by the value of stock options, expected net income increases by $E_t[O]$, or $E_t[NI^{A3}_{t+j}] = E_t[NI_{t+j} + O]$. Since beginning book values, or $E_t[BV_{t+j-1}]$, are the same under both scenarios, residual earnings in period $t + j$ under scenario 3 is greater than that under scenario 1 (and 2) by the amount of $E_t[O]$. For period $t + j + 1$, beginning book value increases by $E_t[O]$, so $E_t[BV^{A3}_{t+j}] = E_t[BV_{t+j} + O]$. At the same time, net income also increases due to the returns on the cash reserved from reducing cash salary in period $t + j$. Under the assumption that the cash savings are invested in investments that earn a return equal to cost of capital r, $E_t[NI^{A3}_{t+j+1}]$ can be written as $E_t[NI_{t+j+1} + r * O]$. Therefore, residual earnings in period $t + j + 1$ can be rewritten as $E_t[(NI_{t+j+1} + r * O) - r * (BV_{t+j} + O)]$, or $E_t[NI_{t+j+1} - r * BV_{t+j}]$. That is, issuing employee stock options in period $t + j$ does not affect the residual earnings in $t + j + 1$. The same reasoning can be applied to all periods after $t + j + 1$.

Taken together, expected future residual earnings are the same under scenarios 1 and 3 for all future periods except for period $t + j$, in which residual earnings is higher under scenario 3 by the amount of $E_t[O]$. Therefore, $V^{E3}_t = V^{E1}_t + \frac{E_t[O]}{(1+r)^j}$, as shown in equation (A3). In other words, the value obtained from the traditional residual income model is greater under scenario 3

than that under scenario 1. Under the assumption that anticipated stock option compensation does not affect the value of common shareholders, the correct value of common stock is V_t^{E1}. Consequently, in order to obtain the correct valuation of common stock, the discounted value of future option issuance, or $\frac{E_t[O]}{(1+r)^j}$, has to be deducted from V_t^{E3}, the value obtained from the traditional residual income model computed based on earnings before stock option expense.

Scenario 4: Valuation of common stock with an anticipated employee stock option issue at the end of period t + j and no expected security issuance in other future periods – fair value method

Again let O denote the fair value of options issued to employees. In addition, let V_t^{E4}, NI_t^{A4} and BV_t^{A4} be the value obtained from the traditional residual income model, accounting earnings and book value under scenario 4. The value obtained from the residual income model can be written as:

$$V_t^{E4} = BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i}^{A4} - r * BV_{t+i-1}^{A4}\right]}{(1+r)^i}$$

$$= BV_t + \sum_{i=1}^{j-1} \frac{E_t[NI_{t+i} - r * BV_{t+i-1}]}{(1+r)^i} + \frac{E_t[NI_{t+j}^{A4} - r * BV_{t+j-1}]}{(1+r)^j} +$$

$$\frac{E_t[NI_{t+j+1}^{A4} - r * BV_{t+j}^{A4}]}{(1+r)^{j+1}} + \sum_{i=2}^{\infty} \frac{E_t[NI_{t+j+i}^{A4} - r * BV_{t+j+i-1}^{A4}]}{(1+r)^{j+i}}$$

$$= BV_t + \sum_{i=1}^{\infty} \frac{E_t\left[NI_{t+i} - r * BV_{t+i-1}\right]}{(1+r)^i}$$

$$= V_t \qquad \text{(A4)}$$

Note that expected residual earnings for periods $t + 1$ to $t + j - 1$ are the same under scenarios 1 and 4. For period $t + j$, because the firm is expected to recognize option expense, expected net income remains the same, or $E_t[NI_{t+j}^{A4}] = E_t[NI_{t+j}]$. As a result, residual income in period $t + j$ under scenario 4 is identical to that under scenario 1. For period $t + j + 1$, beginning book value increases by $E_t[O]$, so $E_t[BV_{t+j}^{A4}] = E_t[BV_{t+j} + O]$. At the same time, net income also increases due to the returns on the cash reserved from salary reduction in period $t + j$. Similar to the analysis in scenario 3, the residual earnings for period $t + j + 1$ are identical under scenarios 1 and 4. The same reasoning can be applied to all periods after $t + j + 1$. Taken together, expected residual earnings are identical under scenarios 1 and 4 for all future periods. Consequently, $V_t^{E4} = V_t^{E1}$. In other words, the value obtained from the traditional residual income model,

computed based on earnings after stock option expense, is equal to the value of common stock.

The derivation of the residual income valuation under scenarios 1 to 4 demonstrates that for a firm with option compensation and recognizing no option expense, the value of expected future options should be subtracted in order to obtain proper valuation of common stock. Such adjustment, however, is not necessary for anticipated issuances of common shares, or for options that are accounted for using the fair value method. To understand the intuition behind this, it is useful to relate the accounting system to the residual income model and the dividend discount model. The dividend discount model requires "dividends net of capital contributions" as inputs to valuation (in other words, capital contributions are treated as negative dividends). Theoretically, the two models are mathematically identical if the accounting system satisfies the clean surplus relation, and dividends net of capital contribution recorded in the accounting system capture a firm's "true" underlying time series of dividends net of capital contributions.

Most accounting methods for financing activities satisfy this requirement. The intrinsic value method for employee options, however, does not produce a proper measure of dividends net of capital contribution. To better illustrate this, it is useful to compare the clean surplus relation and the measure of net dividends as determined by the accounting system under scenarios 1 to 4. Again scenario 1 is

used as a benchmark. Under scenario 1 when no issues of common shares or options are expected in period $t + j$, the clean surplus relation for period $t + j$ is:

$$E_t[BV_{t+j}] = E_t[BV_{t+j-1}] + E_t[NI_{t+j}] - E_t[DIV_{t+j}]. \quad \text{(A5)}$$

Under scenario 2 when common shares are issued, a firm would debit cash and credit paid-in capital. Thus, the accounting procedures produce the proper measure of dividends net of capital contributions ($E_t[DIV_{t+j} - S]$):

$$E_t[BV^{A2}_{t+j}] = E_t[BV_{t+j-1}] + E_t[NI^{A2}_{t+j}] - E_t[DIV^{A2}_{t+j}], \text{ or} \quad \text{(A6)}$$

$$E_t[BV_{t+j} + S] = E_t[BV_{t+j-1}] + E_t[NI_{t+j}] - E_t[DIV_{t+j} - S]. \quad \text{(A7)}$$

In scenario 3, under the intrinsic value method, the clean surplus relation can be expressed as:

$$E_t[BV^{A3}_{t+j}] = E_t[BV_{t+j-1}] + E_t[NI^{A3}_{t+j}] - E_t[DIV^{A3}_{t+j}], \text{ or} \quad \text{(A8)}$$

$$E_t[BV_{t+j} + O] = E_t[BV_{t+j-1}] + E_t[NI_{t+j} + O] - E_t[DIV_{t+j}]. \quad \text{(A9)}$$

In scenario 4, under the fair value method, the clean surplus relation is:

$$E_t[BV^{A4}_{t+j}] = E_t[BV_{t+j-1}] + E_t[NI^{A4}_{t+j}] - E_t[DIV^{A4}_{t+j}], \text{ or} \quad \text{(A10)}$$

$$E_t[BV_{t+j} + O] = E_t[BV_{t+j-1}] + E_t[NI_{t+j}] - E_t[DIV_{t+j} - O]. \quad \text{(A11)}$$

Issuance of employee options represents a combination of an operating activity and a financing activity. Conceptually, issuing employee options is identical to issuing common stock and then using the proceeds to compensate employees. Therefore, dividends net of capital contributions should reflect the capital contributed by stock option holders. However, when employee stock

options are issued, under the intrinsic value method, a firm does not have to record such transactions. As a result, the measure of dividends under the intrinsic value method, as shown in equation (A9), does not include the negative dividends $E_t[O]$, which overstates the true value of dividends net of capital contribution. The fair value method, on the other hand, produces a proper measure of net dividends ($E_t[DIV_{t+j} - O]$) as shown in (A11), which is comparable to the measure of net dividends in scenario 2 in (A7).[54]

Since dividends for period $t + j$ under the intrinsic value method are overstated by the fair value of options, and dividends for other periods are identical under scenarios 3 and 4, the value obtained from the dividend discount model using dividends measured under the intrinsic value method is overstated. Correspondingly, since net income for period $t + j$ under the intrinsic value method is overstated by the fair value of options, and net income for other periods and book value for all periods are identical under scenarios 3 and 4, the value obtained from the residual income model using earnings measured under the intrinsic value method is overstated. This is the reason why the value obtained from the traditional residual income model has to be adjusted for expected future option issues when the intrinsic value method is used to account for employee

[54] Note that under both accounting methods, ending book value in period $t + j$ is greater by the amount of O when compared with ending book value under scenario 1, as indicated in equations (A9) and (A11). The increase in ending book value reflects the cash saving from salary deduction through stock option compensation. However, under the intrinsic value method, the increase in ending book value is attributed to the increase in net income (equation (A9)), while under the fair

options. In contrast, the accounting for common share issues and the fair value method for employee stock options do not lead to overstated net income and dividends, so that such adjustment is not required.

value method, net income remains the same and the increase in ending book value is attributed to the capital contributed by option holders (equation (A11)).

Table 1
Sample selection procedure

Panel A: sample used in regression tests of valuation implications of employee stock options

	firm-year observations
S&P 1500 firms with SFAS No. 123 pro forma earnings available in financial statements between 1996 and 2000	6,355
Less: Missing data required to compute the Black-Scholes value of outstanding employee options	930
Missing market data from CRSP[a]	1,129
Missing consensus analyst forecasts from IBES	564
Observations with all required data	3,732
Less: observations with a studentized residual absolute value greater than four in the first stage regressions of the two-stage least squares estimation	55
Final sample	3,677

Panel B: sample used in regression tests of information content of SFAS No. 123 disclosures

	firm-year observations
S&P 1500 firms with SFAS No. 123 pro forma earnings available in years t and t-1 between 1996 and 2000	4,959
Less: Missing 10-K filing dates or earnings announcement dates	180
10-K filed less than three trading days after earnings announcement	68
Missing market data from CRSP[b]	1,171
Missing consensus analyst forecasts from IBES	94
Absolute value of ΔUE greater than 0.1[c]	8
Final sample	3,438

Notes to Table 1:

[a] A firm is required to have stock price data at the end of the third month after fiscal year end, which falls in 2001 for fiscal year 2000 for the majority of firms. Because market data for 2001 is not yet available in CRSP, 1,010 of the 1,129 observations with missing CRSP data are for fiscal year 2000.

[b] A firm is required to have stock return data for the three-day interval around 10-K filing dates, which falls in 2001 for fiscal year 2000 for the majority of firms. 1,060 of the 1,171 observations with missing CRSP data are for fiscal year 2000.

[c] ΔUE is unexpected earnings per share (EPS) deflated by beginning-of-period price, where unexpected EPS is the difference between actual EPS and analysts' EPS forecast, both obtained from I/B/E/S.

Table 2
Descriptive statistics on employee stock option characteristics[a]

Variable[b]	Mean	Std.Dev.	Minimum	25%	Median	75%	Maximum
OUTn	17.44	63.67	0.01	1.98	4.03	10.28	971.00
OUT (%)	8.52	5.72	0.01	4.46	7.20	11.23	63.53
GRANTn	4.94	19.04	0.00	0.49	1.14	3.00	381.62
GRANT (%)	2.68	2.79	0.00	1.03	1.82	3.36	30.74
OUTv	314.48	1,573.00	0.00	13.84	38.90	133.69	39,084.00
OUTvp (%)	4.45	4.66	0.00	1.45	2.92	5.94	59.78
B-S	13.22	10.86	0.00	5.40	10.45	18.10	102.74
P	27.85	16.18	0.94	16.06	24.44	36.69	143.50
GRANTB-S	10.54	6.17	0.35	6.28	9.20	13.28	59.71
X	18.43	11.32	0.29	10.10	16.41	24.33	86.02
P-to-X	1.87	1.68	0.22	1.09	1.50	2.16	61.17
VEST	3.77	1.01	0.50	3.00	4.00	4.00	10.00
EXPIRE	9.72	1.07	5.00	10.00	10.00	10.00	20.00
LIFE	7.08	0.80	1.90	7.00	7.00	7.10	12.00
d	0.01	0.01	0.00	0.00	0.00	0.02	0.21
T	3.06	1.72	0.02	2.00	2.90	4.00	9.60
r	0.06	0.01	0.04	0.05	0.06	0.06	0.12
σ	0.38	0.17	0.01	0.25	0.34	0.47	1.25
Fd	0.01	0.02	0.00	0.00	0.00	0.02	0.38
FT	5.70	1.64	0.50	4.80	5.21	7.00	15.50
Fr	0.06	0.01	0.03	0.05	0.06	0.06	0.08
$F\sigma$	0.38	0.17	0.00	0.25	0.34	0.48	1.37

Notes to Table 2:

[a] The sample consists of 1,113 firms with 3,677 firm-year observations from 1996 to 2000.

[b] Variable definitions:

OUTn:	number of employee stock options outstanding at fiscal year end (millions).
OUT:	number of employee stock options outstanding divided by number of common shares outstanding (%).
GRANTn:	number of employee stock options granted during a fiscal year (millions).
GRANT:	number of employee stock options granted divided by number of common shares outstanding (%).
OUTv:	value of employee stock options outstanding computed using the Black-Scholes model (millions).
OUTvp:	value of employee stock options outstanding divided by market value of common stock (%).
B-S:	fair value per option at the end of the third month after fiscal year end.
P:	share price at the end of the third month after fiscal year end.
GRANTB-S:	fair value per option at grant date.
X:	weighted average exercise price for outstanding employee stock options.
P-to-X:	price-to-strike ratio, computed as *P* divided by *X*.
VEST:	option vesting period.
EXPIRE:	option contractual term to maturity.
LIFE:	weighted average contracted remaining life of outstanding employee stock options.
d, T, r and σ :	dividend yield, option expected life, risk-free interest rate, stock price volatility, respective, used to compute outstanding employee stock options.
Fd, *FT*, *Fr* and *F*σ:	dividend yield, option expected life, risk-free interest rate, and stock price volatility, respective, used by firms to compute option value at grant date, obtained from firms' financial statements.

Table 3
Descriptive statistics for variables used in regression tests of valuation implications of employee stock options[a]

Panel A: Descriptive data

Variable[b]	Mean	Std.Dev.	Minimum	25%	Median	75%	Maximum
P	27.85	16.18	0.94	16.06	24.44	36.69	143.50
BV	9.66	7.27	0.11	4.44	8.02	12.81	66.08
RI_{t+1}	0.41	0.80	-4.93	0.05	0.38	0.82	4.77
RI_{t+2}	0.56	0.76	-4.33	0.16	0.49	0.95	5.40
RILTG	0.09	0.12	-1.04	0.03	0.08	0.15	0.83
FESO	0.08	0.08	-0.25	0.02	0.05	0.10	0.66
OESO	0.72	0.83	0.00	0.20	0.45	0.91	6.13
*FESO**	0.08	0.06	-0.13	0.04	0.07	0.11	0.56
*OESO**	0.78	0.63	-1.92	0.33	0.66	1.10	6.04

Panel B: Correlation coefficients

	P	*BV*	RI_{t+1}	RI_{t+2}	*RILTG*	*FESO*	*OESO*	*FESO**
BV	0.40*							
RI_{t+1}	0.40*	-0.15*						
RI_{t+2}	0.46*	-0.11*	0.95*					
RILTG	0.38*	-0.21*	0.82*	0.88*				
FESO	0.13*	0.05*	0.01	0.06*	0.11*			
OESO	0.44*	-0.13*	0.15*	0.17*	0.29*	0.40*		
*FESO**	0.02	0.06*	-0.03**	0.07*	0.16*	0.61*	0.38*	
*OESO**	-0.05*	-0.22*	0.15*	0.19*	0.35*	0.53*	0.62*	0.69*

Notes to Table 3:

* Statistically significant at the 0.01 level.
** Statistically significant at the 0.05 level.

[a] The sample consists of 1,113 firms with 3,677 firm-year observations from 1996 to 2000.

[b] Variable definitions:

P:	share price at the end of third month after fiscal year end.
BV:	book value of equity at fiscal year end divided by number of shares outstanding.
RI_{t+1}:	expected residual income per share for period $t + 1$; calculated as $ENI_{jt+1} - r*BV_{jt}$, where ENI_{jt+1} is analysts' EPS forecast for fiscal year $t+1$, and r is cost of equity capital (assumed to be 12%).
RI_{t+2}:	expected residual income per share for period $t + 2$; calculated as $ENI_{it+2} - r*(BV_{jt} + ENI_{it+1} - EDIV_{it+1})$, where ENI_{jt+2} is analysts' EPS forecasts for fiscal year $t + 2$; $EDIV_{it+1}$ is expected dividends per share in period $t + 1$, calculated as $PAYOUT_{it} * ENI_{it+1}$, where $PAYOUT_{it}$ is dividends payout ratio in period t.
RILTG:	RI_{t+2} times analysts' forecast of long term earnings growth.
FESO:	stock option expense, calculated as earnings minus pro forma earnings disclosed under SFAS No. 123, divided by number of shares outstanding at fiscal year end.
OESO:	fair value of outstanding employee stock options multiplied by $(1 - TAX)$ and divided by number of shares outstanding at fiscal year end. *TAX* is tax rate (assumed to be 35%).
*FESO**:	predicted value of *FESO* obtained from regressing *FESO* on *Fd*, *FT*, *Fr*, *Fσ*, *GRANT, VEST, BV, NI and GROWTH* (*Fd*, *FT*, *Fr*, *Fσ*, *GRANT* and *VEST* are as defined in notes to table 2).
*OESO**:	predicted value of *OESO* obtained from regressing *OESO* on *d*, *T*, *r*, *σ*, *OUT, BV, NI and GROWTH* (*d*, *T*, *r*, *σ* and *OUT* are as defined in notes to table 2).

Table 4
Regression tests of the valuation implications of employee stock options – Two-stage least squares[a]

Model[b]: $P_{jt} = a_0 + a_1 BV_{jt} + a_2 RI_{jt+1} + a_3 RI_{jt+2} + a_4 RILTG_{jt} + a_5 FESO^*_{jt} + a_6 OESO^*_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model	*BV*	RI_{t+1}	RI_{t+2}	*RILTG*	*FESO**	*OESO**	Adj-R^2
(1)	1.03*	-2.54*	10.70*	18.08*			0.43
	(35.19)	(-3.08)	(10.21)	(4.97)			
(2)	1.04*	-4.06*	11.67*	22.89*	-22.23*		0.44
	(35.69)	(-4.74)	(11.07)	(6.19)	(-6.35)		
(3)	1.00*	-3.01*	10.22*	27.24*		-2.43*	0.44
	(33.89)	(-3.65)	(9.78)	(7.05)		(-6.74)	
(4)	1.01*	-3.60*	10.85*	26.57*	-10.92**	-1.63*	0.45
	(33.44)	(-4.15)	(10.01)	(6.86)	(-2.18)	(-3.15)	

Notes to Table 3:

* Statistically significant at the 0.01 level (two-tailed).
** Statistically significant at the 0.05 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,113 firms with 3,677 firm-year observations from 1996 to 2000.

[b] Variable definitions:

P:	share price at the end of third month after fiscal year end.
BV:	book value of equity at fiscal year end divided by number of shares outstanding.
RI_{t+1}:	expected residual income per share for period $t + 1$; calculated as $ENI_{jt+1} - r*BV_{jt}$, where ENI_{jt+1} is analysts' EPS forecast for fiscal year $t+1$, and r is cost of equity capital (assumed to be 12%).
RI_{t+2}:	expected residual income per share for period $t + 2$; calculated as $ENI_{it+2} - r*(BV_{jt} + ENI_{it+1} - EDIV_{it+1})$, where ENI_{jt+2} is analysts' EPS forecasts for fiscal year $t + 2$; $EDIV_{it+1}$ is expected dividends per share in period $t + 1$, calculated as $PAYOUT_{it} * ENI_{it+1}$, where $PAYOUT_{it}$ is dividends payout ratio in period t.
RILTG:	RI_{t+2} times analysts' forecast of long term earnings growth.
FESO:	stock option expense, calculated as earnings minus pro forma earnings disclosed under SFAS No. 123, divided by number of shares outstanding at fiscal year end.
OESO:	fair value of outstanding employee stock options multiplied by $(1 - TAX)$ and divided by number of shares outstanding at fiscal year end. *TAX* is tax rate (assumed to be 35%).
*FESO**:	predicted value of *FESO* obtained from regressing *FESO* on *Fd*, *FT*, *Fr*, *Fσ*, *GRANT, VEST, BV, NI and GROWTH* (*Fd*, *FT*, *Fr*, *Fσ*, *GRANT* and *VEST* are as defined in notes to table 2).
*OESO**:	predicted value of *OESO* obtained from regressing *OESO* on *d*, *T*, *r*, *σ*, *OUT, BV, NI and GROWTH* (*d*, *T*, *r*, *σ* and *OUT* are as defined in notes to table 2).

Table 5
Regression tests of the valuation implications of employee stock options – Ordinary least square (OLS)[a]

Model[b]: $P_{jt} = a_0 + a_1 BV_{jt} + a_2 RI_{jt+1} + a_3 RI_{jt+2} + a_4 RILTG_{jt} + a_5 FESO_{jt} + a_6 OESO_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model	*BV*	RI_{t+1}	RI_{t+2}	*RILTG*	*FESO*	*OESO*	Adj-R^2
(1)	1.03*	-2.54*	10.70*	18.08*			0.43
	(35.19)	(-3.08)	(10.21)	(4.97)			
(2)	1.02*	-2.13**	10.44*	16.61*	9.50*		0.44
	(35.10)	(-2.55)	(9.95)	(4.55)	(3.60)		
(3)	1.10*	-1.56**	13.18*	-16.86*		8.72*	0.61
	(44.79)	(-2.26)	(14.98)	(-5.32)		(39.61)	
(4)	1.11*	-2.57*	14.12*	-16.57*	-25.24*	9.62*	0.62
	(46.09)	(-3.74)	(16.22)	(-5.31)	(-10.81)	(41.43)	

* Statistically significant at the 0.01 level (two-tailed).
** Statistically significant at the 0.05 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,113 firms with 3,677 firm-year observations from 1996 to 2000.

[b] Variable definitions: refer to notes to table 4.

Table 6
Regression tests of the valuation implications of employee stock options – Two-stage least squares (Including either the one-year ahead or two-year ahead residual earnings) [a]

Panel A: $P_{jt} = a_0 + a_1 BV_{jt} + a_2 RI_{jt+1} + a_4 RILTG_{jt} + a_5 FESO^*_{jt} + a_6 OESO^*_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model[b]	*BV*	RI_{t+1}	*RILTG*	*FESO**	*OESO**	Adj-R^2
(1)	1.09*	4.59*	39.18*			0.42
	(37.72)	(10.22)	(12.91)			
(2)	1.11*	3.65*	46.36*	-24.62*		0.43
	(38.43)	(7.82)	(14.54)	(-6.90)		
(3)	1.05*	3.72*	48.12*		-2.65*	0.43
	(36.11)	(8.06)	(14.79)		(-7.27)	
(4)	1.07*	3.54*	48.67*	-12.43**	-1.74*	0.44
	(35.24)	(7.59)	(14.93)	(-2.43)	(-3.33)	

Panel B: $P_{jt} = a_0 + a_1 BV_{jt} + a_3 RI_{jt+2} + a_4 RILTG_{jt} + a_5 FESO^*_{jt} + a_6 OESO^*_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model[b]	*BV*	RI_{t+2}	*RILTG*	*FESO**	*OESO**	Adj-R^2
(1)	1.04*	7.98*	19.41*			0.44
	(36.05)	(14.20)	(5.37)			
(2)	1.06*	7.38*	24.56*	-20.62*		0.44
	(36.65)	(12.99)	(6.64)	(-6.04)		
(3)	1.01*	7.02*	28.48*		-2.35*	0.44
	(34.90)	(12.15)	(7.39)		(-6.52)	
(4)	1.03*	7.04*	28.07*	-9.62**	-1.62*	0.45
	(34.05)	(12.19)	(7.27)	(-1.97)	(-3.14)	

* Statistically significant at the 0.01 level (two-tailed).
** Statistically significant at the 0.05 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,113 firms with 3,677 firm-year observations from 1996 to 2000.
[b] Variable definitions: refer to notes to table 4.

Table 7
Regression tests of the valuation implications of employee stock options – Two-stage least squares (Alternative proxies for *FESO*) [a]

Model[b]: $P_{jt} = a_0 + a_1 BV_{jt} + a_2 RI_{jt+1} + a_3 RI_{jt+2} + a_4 RILTG_{jt} + a_5 FESO'^{*}_{jt} + a_6 OESO^{*}_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model	*BV*	RI_{t+1}	RI_{t+2}	*RILTG*	*FESO'**	*OESO**	Adj-R^2
*Panel A: FESO' = FESO ** (1+ *analyst forecast of long term earnings growth*)							
(2)	1.03*	-4.11*	11.60*	23.33*	-17.76*		0.44
	(35.43)	(-4.78)	(11.03)	(6.29)	(-6.47)		
(4)	1.01*	-3.65*	10.85*	26.67*	-9.22**	-1.57*	0.45
	(33.82)	(-4.19)	(10.05)	(6.90)	(-2.35)	(-3.04)	
Panel B: FESO' = Fair value of options granted during the year							
(2)	1.00*	-3.19*	10.62*	23.68*	-5.37*		0.44
	(33.21)	(-3.79)	(9.92)	(6.03)	(-6.05)		
(4)	0.97*	-3.08*	10.15*	27.80*	-2.76***	-1.80*	0.44
	(31.63)	(-3.67)	(9.44)	(6.81)	(-1.68)	(-3.06)	

* Statistically significant at the 0.01 level (two-tailed).
** Statistically significant at the 0.05 level (two-tailed).
*** Statistically significant at the 0.1 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,113 firms with 3,677 firm-year observations for the regressions in panel A, and 1,042 firms with 3,390 firm-year observations for the regressions in panel B. The sample period is from 1996 to 2000.

[b] Variable definitions:
FESO': In panel A: *FESO' = FESO**(1+ *analyst forecast of long term earnings growth*), where *FESO* is as defined in notes to table 4;
In panel B: *FESO'* = Fair value of total options granted during the year divided by number of shares outstanding at fiscal year end, where fair value of options granted is calculated as the weighted average grant date fair value per option times the number of options granted during the year.
Other variables: refer to notes to table 4.

Table 8
Regression tests of the valuation implications of employee stock options – Two-stage least squares (*OESO* not adjusted for tax benefits) [a]

Model[b]: $P_{jt} = a_0 + a_1 BV_{jt} + a_2 RI_{jt+1} + a_3 RI_{jt+2} + a_4 RILTG_{jt} + a_5 FESO^*_{jt} + a_6 OESO'^*_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model	*BV*	RI_{t+1}	RI_{t+2}	*RILTG*	*FESO**	*OESO'**	Adj-R^2
(3)	1.00*	-3.01*	10.22*	27.24*		-1.58*	0.44
	(33.89)	(-3.65)	(9.78)	(7.05)		(-6.74)	
(4)	1.01*	-3.60*	10.85*	26.57*	-10.92**	-1.06*	0.45
	(33.44)	(-4.15)	(10.01)	(6.86)	(-2.18)	(-3.15)	

* Statistically significant at the 0.01 level (two-tailed).
** Statistically significant at the 0.05 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,113 firms with 3,677 firm-year observations from 1996 to 2000.

[b] Variable definitions:
OESO': fair value of outstanding employee stock options divided by number of shares outstanding at fiscal year end. *OESO'* is equal to *OESO* divided by 0.65, where *OESO* is as defined in notes to table 4.
Other variables: refer to notes to table 4.

Table 9
Regression tests of the valuation implications of employee stock options – Two-stage least squares (Analyst forecasts of diluted versus basic EPS)[a]

Model[b]: $P_{jt} = a_0 + a_1 BV_{jt} + a_2 RI'_{jt+1} + a_3 RI'_{jt+2} + a_4 RILTG'_{jt} + a_5 FESO*_{jt} + a_6 OESO*_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model	*BV*	RI'_{t+1}	RI'_{t+2}	*RILTG'*	*FESO**	*OESO**	Adj-R^2
(1)	1.01*	-2.64*	10.80*	17.13*			0.44
	(34.78)	(-3.23)	(10.43)	(4.85)			
(2)	1.02*	-4.25*	11.84*	22.27*	-23.46*		0.45
	(35.34)	(-5.00)	(11.37)	(6.20)	(-6.70)		
(3)	0.98*	-3.16*	10.29*	27.17*		-2.62*	0.45
	(33.49)	(-3.87)	(9.98)	(7.20)		(-7.22)	
(4)	1.00*	-3.75*	10.94*	26.45*	-11.01**	-1.80*	0.45
	(33.05)	(-4.37)	(10.21)	(6.99)	(-2.20)	(-3.47)	

* Statistically significant at the 0.01 level (two-tailed).
** Statistically significant at the 0.05 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,113 firms with 3,677 firm-year observations from 1996 to 2000.

[b] Variable definitions:

RI'_{t+1}: expected residual income per share for period $t + 1$; calculated as $ENI'_{jt+1} - r*BV_{jt}$, where ENI'_{jt+1} is analysts' EPS forecast for fiscal year t+1 with an adjustment: when the forecasted EPS is on diluted basis, it is converted to "basic" EPS by multiplying the forecast by the dilution factor from I/B/E/S.

RI'_{t+2}: expected residual income per share for period $t + 2$; calculated as $ENI'_{it+2} - r*(BV_{jt} + ENI'_{it+1} - EDIV_{it+1})$, where ENI'_{jt+2} is analysts' EPS forecasts for fiscal year $t + 2$ with an adjustment: when the forecasted EPS is on diluted basis, it is converted to "basic" EPS by multiplying the forecast by the dilution factor from I/B/E/S.

RILTG': RI'_{t+2} times analysts' forecast of long term earnings growth.

Other variables: refer to notes to table 4.

Table 10
Descriptive statistics for variables used in regression tests of information content of the SFAS No. 123 disclosures[a]

Panel A: Descriptive data

Variable[b]	Mean	Std.Dev.	Minimum	25%	Median	75%	Maximum
CAR10K	0.002	0.056	-0.415	-0.027	-0.001	0.029	0.360
CAREA	0.006	0.084	-0.565	-0.037	0.002	0.043	0.535
CARBTW	0.001	0.169	-0.927	-0.095	-0.006	0.087	1.576
ΔESOEXP	0.002	0.007	-0.094	0.000	0.001	0.002	0.247
UE	0.001	0.008	-0.094	0.000	0.000	0.002	0.097

Panel B: Correlation coefficients

	CAR10K	*CAREA*	*CARBTW*	*ΔESOEXP*
CAREA	-0.003			
CARBTW	-0.107*	0.053*		
ΔESOEXP	-0.044**	0.019	0.022	
UE	-0.003	0.077*	0.010	0.094*

* Statistically significant at the 0.01 level.
** Statistically significant at the 0.05 level.

[a] The sample consists of 1,198 firms with 3,438 firm-year observations from 1997 to 2000.

[b] Variable definitions:

CAR10K: cumulative market adjusted return for the three-day period starting the day before a firm's filing of 10-K.

CAREA: cumulative market adjusted return for the three-day period starting the day before earnings announcement.

CARBTW: cumulative market adjusted return for the period from two days after earnings announcement until two days before 10-K filing.

ΔESOEXP: change in stock option expense per share deflated by share price at the end of fiscal year *t*, where stock option expense is calculated as earnings minus pro forma earnings disclosed under SFAS No. 123.

UE: unexpected EPS deflated by share price at the end of fiscal year *t*, where unexpected EPS is the difference between actual EPS and analysts' EPS forecast, both obtained from I/B/E/S.

Table 11
Regression tests of the information content of the SFAS No. 123 disclosures – 10-K filing interval[a]

Model[b]: $CAR10K_{jt} = a_0 + a_1 \Delta ESOEXP_{jt} + a_2 UE_{jt} + a_3 \Delta GP_{jt} + a_4 \Delta SGA_{jt} + a_5 \Delta DEPAMT_{jt} + a_6 \Delta INTEXP_{jt} + a_7 \Delta RD_{jt} + a_8 \Delta OTHER_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model	*ΔESOEXP*	*UE*	*ΔGP*	*ΔSGA*	*ΔDEPAMT*	*ΔINTEXP*	*ΔRD*	*ΔOTHER*	Adj-R^2
(1)	-0.309**	-0.009							0.010
	(-2.270)	(-0.080)							
(2)	-0.343**	-0.031	0.012	-0.001	0.072	0.045	-0.045	0.004	0.011
	(-2.490)	(-0.260)	(0.720)	(-0.060)	(1.350)	(0.790)	(-0.800)	(0.560)	

***** Statistically significant at the 0.01 level (two-tailed).
****** Statistically significant at the 0.05 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,198 firms with 3,438 firm-year observations from 1997 to 2000.

[b] Variable definitions:

CAR10K: cumulative market adjusted return for the three-day period starting the day before a firm's filing of 10-K.

ΔESOEXP: change in stock option expense per share deflated by share price at the end of fiscal year *t*, where stock option expense is calculated as earnings minus pro forma earnings disclosed under SFAS No. 123.

UE: unexpected EPS deflated by share price at the end of fiscal year *t*, where unexpected EPS is the difference between actual EPS and analysts' EPS forecast, both obtained from I/B/E/S.

ΔGP: change in gross profit per share deflated by share price at the end of fiscal year *t*, where gross profit is equal to sales minus cost of goods sold.

ΔSGA: change in selling, general and administrative expense per share deflated by share price at the end of fiscal year *t*.

ΔDEPAMT: change in depreciation and amortization per share deflated by share price at the end of fiscal year *t*.

ΔINTEXP: change in interest expense per share deflated by share price at the end of fiscal year *t*.

ΔRD: change in research and development expense per share deflated by share price at the end of fiscal year *t*.

ΔOTHER: change in other expense per share deflated by share price at the end of fiscal year *t*, where other expense is equal to *GP* minus *SGA*, *DEPAMT*, *INTEXP*, *RD*, and net income.

Y_i: year indicator variable; Y_i equals one for year *i* and zero otherwise, where *i* is from 1997 to 1999.

Table 12
Regression tests of the information content of the SFAS No. 123 disclosures – the interval between earnings announcement and 10-K filings, and earnings announcement interval[a]

Model A[b]: $CARBTW_{jt} = a_0 + a_1 \Delta ESOEXP_{jt} + a_2 UE_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Model B[b]: $CAREA_{jt} = a_0 + a_1 \Delta ESOEXP_{jt} + a_2 UE_{jt} + \sum b_i Y_i + \varepsilon_{jt}$

Panel A: The interval between earnings announcement and 10-k filing

Model	*ΔESOEXP*	*UE*	Adj-R^2
(A)	0.397	0.208	0.012
	(0.970)	(0.600)	

Panel B: Earnings announcement interval

Model	*ΔESOEXP*	*UE*	Adj-R^2
(B)	0.102	0.779*	0.018
	(0.500)	(4.550)	

* Statistically significant at the 0.01 level (two-tailed).
** Statistically significant at the 0.05 level (two-tailed).
T-statistics are reported in parenthesis.

[a] The sample consists of 1,198 firms with 3,438 firm-year observations from 1997 to 2000.

[b] Variable definitions:

CARBTW: cumulative market adjusted return for the period from two days after earnings announcement until two days before 10-K filing.

CAREA: cumulative market adjusted return for the three-day period starting the day before earnings announcement.

ΔESOEXP: change in stock option expense per share deflated by share price at the end of fiscal year *t*, where stock option expense is earnings minus pro forma earnings disclosed under SFAS No. 123.

UE: unexpected EPS deflated by share price at the end of fiscal year *t*, where unexpected EPS is the difference between actual EPS and analysts' EPS forecast, both obtained from I/B/E/S.

Y_i: year indicator variable; Y_i equals one for year *i* and zero otherwise, where *i* is from 1997 to 1999.

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